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SECTION 1

1.0
INTRODUCTION

This document is the Ecological Resources Technical Report prepared as supporting documentation for the Environmental Impact Statement (EIS) for a proposed coal-fired power plant which the Thousand Springs Generating Company (TSGC) plans to construct and operate in Elko County, Nevada. TSGC is a consortium of investors. Sierra Pacific Resources is a member of the consortium and acts as project manager for the consortium. The proposed project involves a land exchange with the Bureau of Land Management (BLM) as well as construction and operation of the power plant and is called the Thousand Springs Power Plant (TSPP) project.

1.1 LAND ACQUISITION

The proposed action relative to land acquisition is to conduct a land exchange between the TSGC and the BLM. TSGC is offering approximately 12,774 acres of private lands in the Snake Mountains and 640 acres in Toano Draw in exchange for approximately 15,962 acres of public lands in Toano Draw.

The proposed land exchange would proceed on a surface estate only basis (i.e., mineral rights to the lands would not be exchanged). Measures would be taken to protect access to enable the BLM to continue to administer the public lands in the Toano Draw area. Accordingly, all previous access routes from all directions will be preserved for public access purposes except for the immediate fenced project area.

1.2 DESCRIPTION OF THE PROPOSED POWER PLANT

1.2.1 Design of the Power Plant

The TSPP electric generation complex, upon completion of development, would consist of eight 250-megawatt (MW) (nominal net) coal-fired, steam-electric generating units, designed for baseload duty but with load cycling capability. The proposed action would be eight units that are essentially replicates of the Number Two generating unit at the North Valmy Power Plant, jointly owned by Sierra Pacific Power Company (Reno, Nevada) (a subsidiary of Sierra Pacific Resources) and Idaho Power Company (Boise, Idaho). It is expected that the air emissions control systems for TSPP would be similar to the North Valmy Unit Two system with modifications as would be necessary to comply with regulations that have become effective since that unit was constructed. The proposed design for TSPP would burn pulverized low-sulfur western coal, use a dry-type sulfur dioxide scrubber to conserve water, use a baghouse filter for particulate removal as the most effective available technology in conjunction with the use of low-sulfur coal, and use a counterflow cooling tower as the most favorable based on net energy efficiency--low pumping requirements--and to minimize potential freezing problems. Any deviations from the basic design of North Valmy Unit Two would be dictated by a change in governmental regulations, Best Available Control Technology (BACT) requirements, modernization of equipment by suppliers, or engineering needs due to the difference in location and altitude. The Number Two generating unit at North Valmy was selected as the proposed design because of its reliability and availability, and also because of its ability to meet or exceed current environmental regulations with proven technology. This was recognized by the National Society of Professional Engineers when it was named as one of ten outstanding engineering achievements of 1985 in the United States.

Major components of each power generation unit would be as follows: the steam generator (boiler); turbine-generator; air emissions control systems (baghouse, dry scrubber, boiler); stack; circulating water (cooling water) system; water supply, storage, and treatment facilities; waste management and disposal facilities; fuel receiving, storage, and handling facilities; fire protection systems; emergency power; and construction worker accommodations. Ancillary facilities for the plant as a whole would include access road(s), parking areas, railroad spur, switchyard, offices, warehouses, maintenance facilities, and temporary construction facilities. An 8-foot-high chainlink security fence would be provided around the main plant area. Gates would be provided at all access roads and railroad entrances.

1.2.2 Construction-Worker Accommodations

On-site housing would be provided for the construction workers. Bachelor quarters would be provided for approximately 220 construction personnel. The quarters would be composed of several buildings and could house two workers to a room with a bathroom. There would be a staffed kitchen, mess hall, laundry room, and recreation hall.

In addition, a recreational vehicle park would be constructed to accommodate approximately 300 vehicles. This park would consist of parking spaces, electrical, water, and sewer hook-ups, shower/toilet facilities, and laundry building.

1.2.3 Access Road

The proposed plant access road would run from Highway 93 near Wilkins, east for approximately 4 miles along an existing county road, and then southeast to the project site. The county road would be upgraded, and approximately 10 miles of new road would be constructed from the county road southeast to the plant site. A stream-crossing culvert would be used to cross the main channel of Thousand Springs Creek. An earthen embankment would carry the road across the remainder of the floodplain. Smaller pipe culverts would be used, as required, for crossing other minor drainage channels. The access road to the plant would be fenced with a three- or four-wire, BLM-specified fence to prevent domestic livestock from encroaching on the road but allow wildlife to cross. A paved parking area would be provided near the administration offices. Gravel bed maintenance roads would be used to service the evaporative wastewater pond and cooling tower.

1.2.4 Railroad

The Southern Pacific Railroad has a two-track line from east of the plant site that passes through Montello and Cobre to Wells. A railroad spur, to transport coal to the facility, would be constructed off of the Southern Pacific Railroad track beginning approximately 3 miles northwest of Cobre at Valley Pass and would travel northwest to the plant site. The railroad spur, unloading loop, and switchyard would be designed and constructed in conformance with railroad standards. The railroad spur to the plant site would be fenced using the same specifications as those for the access road. The loop would be designed so that two unit trains could unload coal simultaneously.

1.2.5 Construction of the Power Plant

The proposed power plant, upon completion of development, would consist of eight 250 MW coal-fired, steam-electric generating units. Construction of the first unit would fall into seven distinguishable but overlapping phases:

1. Access road construction and site preparation
2. Construction of internal access and utility network
3. Construction of plant facilities (housing, shops, fire pumphouse, etc.)
4. Concrete foundation installation
5. Structural steel erection
6. Major equipment and main building erection
7. Piping, electrical connection, and instrumentation installation

Construction of the first unit is scheduled to commence in early 1991 and be completed in late 1994. Commercial operation of this unit is anticipated in the second quarter of 1994. Construction of additional generating units would require about 34 months each and would overlap with the preceding unit by 10 months. This would allow for an efficient transition of resources from unit to unit.

The first peak of construction workers is anticipated to be 805 workers in 1993, associated with construction of Units 1 and 2. The average workforce during that year is anticipated to be approximately 500. A second workforce peak is anticipated between the completion of the fourth and fifth units.

Site clearing, grading, and surfacing would be confined to those areas to be built upon, utilized during construction, or which are part of the ash disposal area. Site clearing would be conducted on an "as-required basis," and individual areas would be cleared just prior to construction startup. Vegetation that required removal would be disposed of on site in a Class III disposal site. In total, approximately 1780 acres of land would be disturbed at the power plant site upon completion of development.

1.2.6 Operation of the Power Plant

The proposed action is for the power plant to be a baseload power plant, operating 24 hours a day, 365 days per year. The plant would operate using three 8-hour workshifts. The operational workforce would be approximately 145 persons, for each pair of units or 564 operation workers upon buildout of all eight units.

Coal would be delivered to the plant site by unit trains. The coal would be produced from mines at Kemmerer, Wyoming and Scofield, Utah. Each mine would supply coal in an amount equal to 50 percent of the heat input to the generating units. Coal would be delivered along a new rail spur, approximately 14 miles long, between the Southern Pacific Transportation

Company's main line at Valley Pass and the plant site. It would be the responsibility of Southern Pacific Railroad to deliver coal to and over the new rail spur and to the power plant.

The turbine-generator of each unit would have a nominal gross (nameplate guarantee) rating of 267,521 kilowatts (kW), which would yield a net output of 250,000 kW. The maximum gross generating capability (maximum load) for each unit would be 292,666 kW with the control valves wide open, and steam at 5 percent overpressure (above the nominal design pressure).

The estimated normal average load factor for a unit would be 85.8 percent for the first 5 years of operation. The load factor would progressively decrease to an estimated 53.2 percent in the 31st year of operation and thereafter. The average load factor for each unit over its expected 35 years of operation would be about 75 percent.

The air emissions control system would reduce the stack gas emissions of particulate matter (fly ash) and sulfur dioxide (SO_2) to below the regulatory prescribed maximums. The control system would include a lime spray dry scrubber system to remove sulfur oxides (SO_x) and a fabric filter to remove particulates. Generation and emission of nitrogen oxides (NO_x) would be controlled by design and control of the combustion process within the furnace.

Water, for use in generating steam and for transferring plant generated waste heat to the atmosphere, would be obtained from wellfields in the Thousand Springs drainage basin. The wellfield to supply two or three generating units would be located in Toano Draw Subbasin, which is also where the power plant would be located. For the other five or six units, it is expected that one or more wellfields would be developed along the lower reaches of Thousand Springs Creek in the vicinity of Gamble Ranch. The estimated maximum plant water requirement is 4000 acre-feet/year per generating unit, or 32,000 acre-feet/year upon completion of plant development.

Water management facilities at the power plant would be designed for "zero discharge." The maximum practical reuse and recycling of water is planned. All wastewaters generated by the plant which could no longer be reused would be evaporated from on-site holding ponds, so there would be no off-site discharge of any plant wastewaters.

1.3 DESCRIPTION OF ALTERNATIVES

In addition to the Proposed Action, several alternatives were identified. The alternatives considered in this analysis are grouped into five categories: power generation alternatives, site alternatives, project component alternatives, land acquisition alternatives, and no action alternative. Table 1-1 summarizes all project component alternatives considered and those selected for analysis.

The remainder of this document is organizes as follows: Section 2.0 defines the Geographic Area of Influence, or Study Area; Section 3.0 describes the Affected Environment for Vegetation Resources; Section 4.0 describes the Affected Environment for Wildlife and Aquatic Resources; and Section 5.0 discusses the Ecological Resources Impacts. Section 6.0 lists references.

Table 1-1. SUMMARY OF ALL PROJECT COMPONENT ALTERNATIVES CONSIDERED AND THOSE SELECTED FOR ANALYSIS

Project Component	Proposed Action	Alternatives Considered	Alternatives Selected for Analysis
Power Generation	Eight 250-MW coal-fired units	Solar Wind Nuclear Fusion Geothermal Hydroelectric Solid Waste Cogeneration Oil or Natural Gas Nuclear Fission	No Action
		No Action	
Site	Toano Draw	Nine Candidate Site Regions Throughout the State	None
Access Road	Off of Highway 93 near Wilkins	Moor Summit Off of State Highway 233 Near Cobre	Moor Summit
		Brush Creek Off of Highway 93 3.5 Miles South of Wilkins	Brush Creek
Railroad	Off of Southern Pacific near Cobre	Off of Union Pacific near Wells Paralleling Highway 93	None
Construction Workers Accommodations	On-site Construction-Worker Camp and RV Park	Construction-Worker Camp and RV Park Near Cobre	No Construction-Worker Camp
		Construction-Worker camp and RV Park Near Wilkins	
		No Worker-camp	

Table 1-1. SUMMARY OF ALL PROJECT COMPONENT ALTERNATIVES CONSIDERED AND THOSE SELECTED FOR ANALYSIS (continued)

Project Component	Proposed Action	Alternatives Considered	Alternatives Selected for Analysis
Cooling System	Mechanical Draft Cooling Towers	Natural Draft Cooling Towers Cooling Ponds Dry Mechanical Draft Cooling Towers Wet/Dry Towers	None
Water Supply	Wellfield for 3 Units South of Plant Site in Toano Draw; Wellfield for 5 Units in Gamble Ranch Vicinity	Wellfield for 2 Units South of Plant Site in Toano Draw; Wellfield for 1 Unit North of Plant Site in Toano Draw; Wellfield for 5 Units in Gamble Ranch Vicinity Wellfield for 2 Units South of Plant Site in Toano Draw; Wellfield for 6 Units in Gamble Ranch Vicinity	Wellfield for 2 Units South of Plant Site in Toano Draw; Wellfield for 1 Unit North of Plant Site in Toano Draw; Wellfield for 5 Units in Gamble Ranch Vicinity Wellfield for 2 Units South of Plant Site in Toano Draw; Wellfield for 6 Units in Gamble Ranch Vicinity

Table 1-1. SUMMARY OF ALL PROJECT COMPONENT ALTERNATIVES CONSIDERED AND THOSE SELECTED FOR ANALYSIS (continued)

Project Component	Proposed Action	Alternatives Considered	Alternatives Selected for Analysis
Oxides of Nitrogen Control	Low-NO_x burner with combustion modification	Selective Catalytic Reduction with Ammonia Noncatalytic Reduction with Ammonia Noncatalytic Reduction with Area Low NO_x Burner Flue Gas Recirculation Fluid Bed Combustion	None
Sulfur Dioxide Control	Lime Spray Drier	Wet Scrubber Fluid Bed Combustion Limestone Injection into Furnace Dry Lime Injection into Duct	None
Particulate Matter Control	Baghouse	Electrostatic Precipitator	None

Table 1-1. SUMMARY OF ALL PROJECT COMPONENT ALTERNATIVES CONSIDERED AND THOSE SELECTED FOR ANALYSIS (concluded)

Project Component	Proposed Action	Alternatives Considered	Alternatives Selected for Analysis
Land Acquisition	Land Exchange	Land Tenure Adjustment	Land Tenure Adjustment
		Selling the Public Lands	Selling the Public Lands
		No Action	No Action

Table 1-1. SUMMARY OF ALL PROJECT ALTERNATIVES CONSIDERED AND THOSE SELECTED FOR ANALYSIS (Concluded)

Project Component	Proposed Action	Alternatives Considered	Alternatives Selected
Oxides of Nitrogen Control	Low-NO_x burner with combustion modification	Selective Catalytic Reduction with Ammonia Noncatalytic Reduction with Ammonia Noncatalytic Reduction with Urea Low NO_x Burner Flue Gas Recirculation Fluid Bed Combustion	None
Sulfur Dioxide Control	Lime Spray Drier	Wet Scrubber Fluid Bed Combustion Limestone Injection into Furnace Dry Lime Injection into Duct	None
Particulate Matter Control	Baghouse	Electrostatic Precipitator	None

SECTION 2

2.0
GEOGRAPHIC AREA OF INFLUENCE (GAI)

Vegetation and wildlife resources are described in the sections below. As a basis for this analysis, the geographic area of influence (GAI), or study area, for vegetation and wildlife resources is addressed. In addition, data collection methodology and sources of baseline information are described. Those issues requiring additional analysis, e.g., potential impacts to riparian zones are identified.

2.1 DIRECT IMPACTS

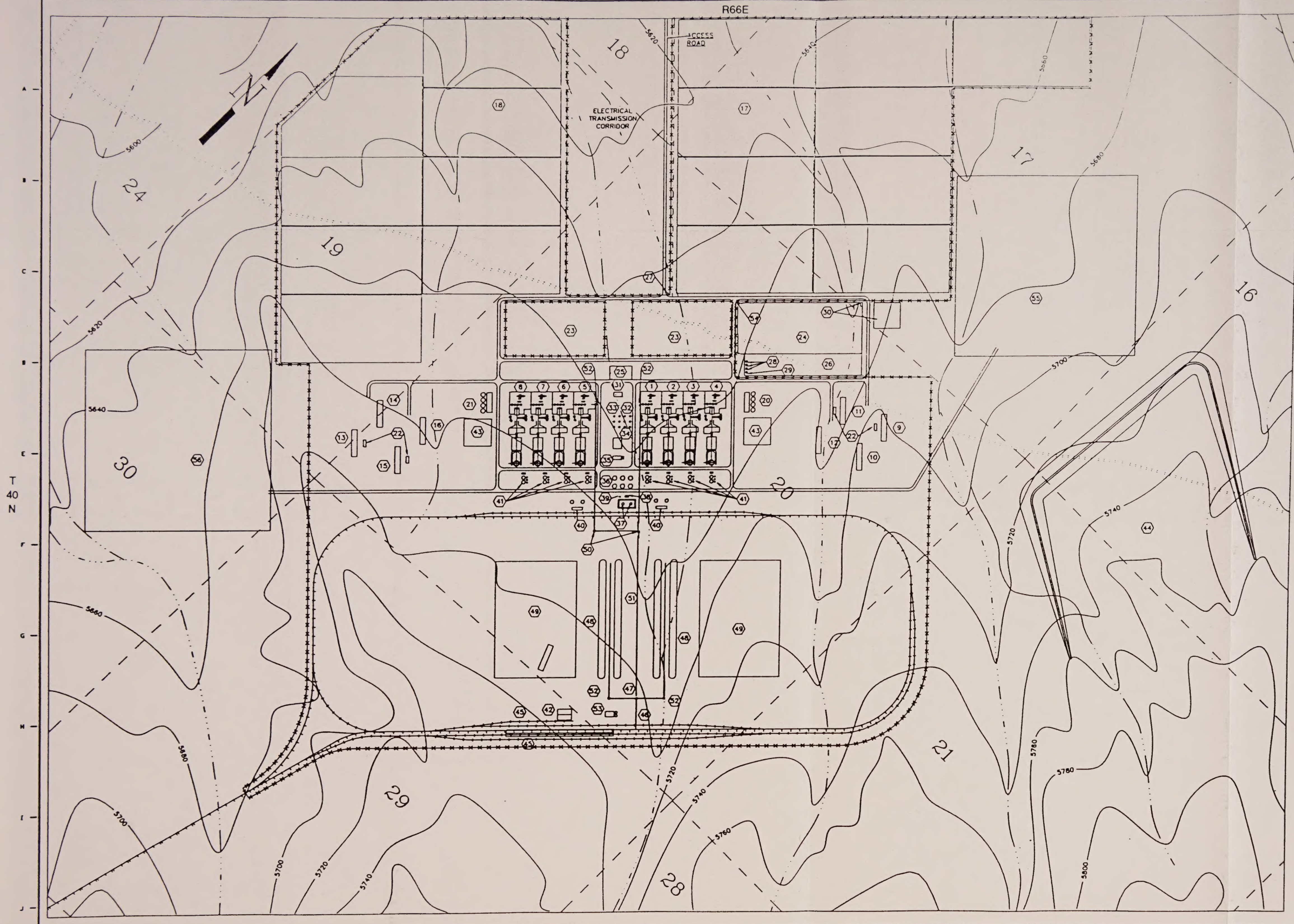
Areas that would be likely to receive direct impacts include the plant site area and proposed utility corridors (Figures 2-1 and 2-2). Those impacts to vegetation and wildlife which are caused by the proposed actions and occur at the same time and place will be referred to as direct impacts (e.g., habitat loss direct mortality, displacement, and loss of carrying capacity). These impacts were assessed for specific areas, as follows:

- Approximately 1280 acres comprising the proposed plant site (Including the proposed area for the plant site, construction-worker camp, wastewater ponds, coal storage areas, etc.
- Right-of-way (ROW) for TSPP access roads, railroads, and powerlines associated with wellfields
- Wellfields (Figure 2-2), access roads, well houses, powerlines, and water pipelines

In addition to lands currently owned by Thousand Springs Generating Company (TSGC), public lands managed by the Bureau of Land Management (BLM) would be required for the proposed project facility described above. The proposed plant site area, utility corridors, and wellfields in Toano Draw are located in a checkerboard public/private land ownership pattern. TSGC has proposed a land exchange with the BLM to acquire the land required for the project. In exchange for approximately 15,962 acres of selected public land in Toano Draw, the BLM would acquire approximately 12,774 acres of private land in the Snake Mountain Range, northwest of Wells, Nevada and 640 acres of private land in Toano Draw. It should be noted that not all exchange lands would be directly affected by construction or operation of project facilities. These federal selected lands include mule deer yearlong and winter habitats (6280 acres), antelope winter and summer habitats (17,520 acres), elk summer and winter habitats (1920 acres), and sage grouse brooding, breeding, and wintering habitats (1980 acres). Important wildlife habitats in these offered lands include 14,599 acres of mule deer summer habitat, 17,318 acres of antelope summer habitat, and 10.5 miles of creeks. The focus of analysis for biological resources will be on the exchange lands in Toano Draw with potential to be affected by project facilities. The biological resources of the offered lands are described in the EIS primarily from a regional perspective. Additional site-specific data are available from a recent inventory of waters and riparian/aquatic habitats on the offered lands in the Snake Mountains conducted by BLM biologists to determine the value of these lands (BLM 1986). This water inventory included field work in the Loomis Creek, Pole Creek (eastern and western slopes), and Cold Springs Creek watersheds and is summarized in this report.

2.2 INDIRECT IMPACTS

In addition to the areas that would be directly disturbed, other areas would be indirectly affected. This area of influence is difficult to quantitatively define for the Thousand Springs Power Plant (TSPP) Project



LEGEND

① UNIT NO. 1 POWERHOUSE (INCL. ABSORBER BLDG., BAGHOUSE & STACK)
② UNIT NO. 2 POWERHOUSE (INCL. ABSORBER BLDG., BAGHOUSE & STACK)
③ UNIT NO. 3 POWERHOUSE (INCL. ABSORBER BLDG., BAGHOUSE & STACK)
④ UNIT NO. 4 POWERHOUSE (INCL. ABSORBER BLDG., BAGHOUSE & STACK)
⑤ UNIT NO. 5 POWERHOUSE (INCL. ABSORBER BLDG., BAGHOUSE & STACK)
⑥ UNIT NO. 6 POWERHOUSE (INCL. ABSORBER BLDG., BAGHOUSE & STACK)
⑦ UNIT NO. 7 POWERHOUSE (INCL. ABSORBER BLDG., BAGHOUSE & STACK)
⑧ UNIT NO. 8 POWERHOUSE (INCL. ABSORBER BLDG., BAGHOUSE & STACK)
⑨ UNIT NO. 1 COOLING TOWER
⑩ UNIT NO. 2 COOLING TOWER
⑪ UNIT NO. 3 COOLING TOWER
⑫ UNIT NO. 4 COOLING TOWER
⑬ UNIT NO. 5 COOLING TOWER
⑭ UNIT NO. 6 COOLING TOWER
⑮ UNIT NO. 7 COOLING TOWER
⑯ UNIT NO. 8 COOLING TOWER
⑰ UNITS 1 - 4 EVAPORATION PONDS (NINE 25 ACRE PONDS)
⑱ UNITS 5 - 8 EVAPORATION PONDS (EIGHT 25 ACRE PONDS)
⑲ NOT USED
⑳ CIRCULATING WATER TREATMENT & CLARIFIERS - UNITS 1 - 4
㉑ CIRCULATING WATER TREATMENT & CLARIFIERS - UNITS 5 - 8
㉒ CHLORINATION BUILDING
㉓ SWITCH YARD
㉔ CONSTRUCTION CAMP
㉕ WAREHOUSE
㉖ CONSTRUCTION PARKING
㉗ MAIN GATE GUARD HOUSE
㉘ CONSTRUCTION CRAFT CHECK STATION
㉙ CONSTRUCTION CHANGE HOUSE
㉚ SEWAGE TREATMENT SEDIMENTATION TANK & STABILIZATION POND
㉛ ADMINISTRATION BUILDING
㉜ DEMINERALIZED WATER STORAGE TANKS
㉝ CONDENSATE STORAGE TANKS
㉞ WATER TREATMENT BUILDING
㉟ FIRE PUMP HOUSE AND DOMESTIC WATER TANKS
㊱ RAW WATER STORAGE TANKS
㊲ FUEL OIL STORAGE TANKS
㊳ FUEL OIL UNLOADING / TRANSFER PUMP HOUSE
㊴ FIRE PROTECTION FOAM BUILDING
㊵ LIME UNLOADING STORAGE FACILITY
㊶ ASH HANDLING AREA
㊷ MAINTENANCE BUILDING
㊸ CONSTRUCTION FACILITIES
㊹ RAW WATER STORAGE RESERVOIR
㊺ COAL UNLOADING TRESTLE AND HOPPERS
㊻ COLLECTING TRANSFER CONVEYOR
㊼ SAMPLING AND TRANSFER HOUSE
㊽ LIVE COAL STORAGE
㊾ DEAD COAL STORAGE
㊿ CRUSHER HOUSE
(51) PLANT CONVEYORS
(52) TRANSFER TOWER
(53) DUST SUPPRESSION BUILDING
(54) CONSTRUCTION SITE GUARDHOUSE
(55) SOLID WASTE DISPOSAL AREA - UNITS 1 - 4
(56) SOLID WASTE DISPOSAL AREA - UNITS 5 - 8

500 0 500 1000
scale feet

EXISTING NATURAL DRAINAGE
EXISTING DIRT TRAIL

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CIVIL
CONCEPTUAL PLOT PLAN
(8 UNITS)

THOUSAND SPRINGS POWER PLANT
SIERRA PACIFIC RESOURCES COMPANY

ORDER NO.	SCALE		DWG. NO.	REV.
9366.001	1"=500'	UNITED ENGINEERS & CONSTRUCTORS Stearns-Roger DIVISION	SK-002-002	P1

Figure 2-1. FACILITY PLOT PLAN

CAD NO. THSPGC01
08/28/89 RKP

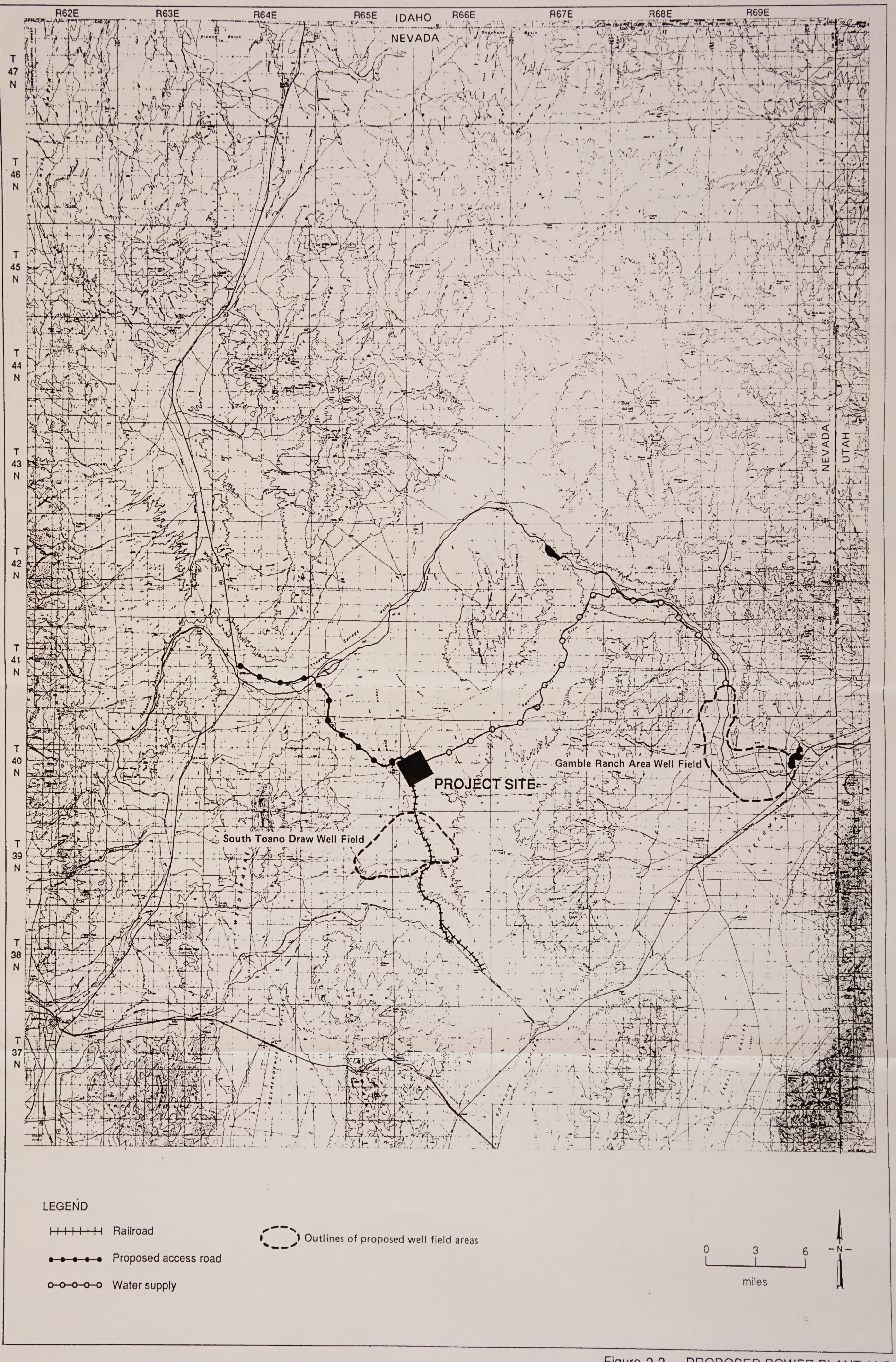

Figure 2-2. PROPOSED POWER PLANT AND ANCILLARY FEATURES

because of the wide range and source of indirect impacts. For purposes of the biological impact analysis, the area of influence for indirect impacts was assumed to be the area from the Snake Mountains east to the Utah state line, and from Wells, Nevada north to the Idaho state line. This area was analyzed because it encompasses the region which is within a reasonable travel distance to recreation for the anticipated workforce and could receive impacts from increased human disturbance. In addition to this area defined for indirect impacts, an even larger area was examined for the potential impacts from acid rain. Because acid rain is a long distance transport issue, the area of potential impacts was defined by the air current patterns discussed in the air quality analysis.

SECTION 3

3.0
AFFECTED ENVIRONMENT FOR VEGETATION RESOURCES

3.1 METHODOLOGY

Vegetation surveys of the proposed plant site and Toano Draw exchange lands were conducted in May 1987 and June 1988. During these inventories, vascular plant species were identified and quantitative estimates were obtained for plant cover, density, and frequency within each major vegetation type.

Quantitative sampling of the vegetation was undertaken to characterize vegetation canopy cover and woody plant density. Within the study area, representative areas were selected for sampling purposes. These areas were selected based on the homogeneity of the vegetation and the representativeness of the vegetation parameters to be sampled.

A 50-meter belt transect was placed at each sampling location. Shrub cover was estimated utilizing the 50-meter transect for line intercept measurements. Herbaceous cover was sampled by ocular estimate within a 1-square-meter quadrant. Five quadrats were placed randomly along the transect. Shrub density was estimated by counting the number of adults and seedlings by species within each 3 x 50-meter belt transect. All adult individual shrubs rooted in the plots were counted. Adult plants were defined as individuals greater than 8 centimeters tall.

For each transect sampled, percent cover for each species, as well as litter, rock, and bareground were recorded. The quadrants along a transect were averaged to yield one sample per transect. The data for all transects within a vegetation type were averaged together to provide mean cover values for that vegetation type. Summary tables show percent cover by general cover class (e.g., litter, rock, bareground, foliage cover), cover by species for each site, and the relative cover values for each species. Shrub density counts for each species were also recorded for each 3 x 50-meter belt transect sampled. Density calculations were made, averaged for all sites, and the stems/acre were calculated.

In addition to quantitative vegetation surveys, the plant site and Toano Draw land exchange area were assessed for potential occurrence of rare plants. Prior to field activities, appropriate literature was reviewed, including expert consultation, monographs, geologic maps, and topographic maps. Additionally, the following agencies and institutions were contacted regarding information on vegetation type and rare plant species distribution: Nevada State Museum, Carson City; Nature Conservancy, Carson City; Bureau of Land Management, Elko; and Utah State University, Logan. The Bureau of Land Management and the Nevada State Museum identified rare plants which were likely to occur within the study area.

All field activities and quantitative sampling for rare plants were conducted in May 1987 and June 1988. Habitats with a high potential for rare plant occurrence were 100 percent searched. Other sites with lower potentials were searched less intensively. Each site was traversed by foot, and collections of unknown plant species were made. A complete species list was compiled at this time. These plant collections were deposited at the Intermountain Herbarium at Utah State University, Logan.

Surveys of riparian vegetation along the Thousand Springs drainage from the Winecup Ranch drainshear to Dake Reservoir will be conducted in June 1989. A work plan for these surveys has been submitted. A rare plant survey will also be conducted during this period for railroad and water pipeline corridors.

3.2 VEGETATIVE COMMUNITIES AT PLANT SITE

Within the plant site area and Toano Draw exchange lands, including Thousand Springs Creek, the following vegetation types were identified: Black Sagebrush, Shadscale, Saltbush, Big Sagebrush, and Riparian. Minor vegetation phases which were identified within the area included Winterfat, Mixed Desert Shrub, and Crested Wheatgrass. Each vegetation type is described in the following sections. Complete species lists are included in Appendix A to this technical report.

3.2.1 Black Sagebrush Type

This vegetation type occurs on shallow soils, usually on convex positions of alluvial fans found on the plant site. This is a low-growing vegetation type dominated primarily by black sagebrush (Artemisia Nova), which is generally less than 4 decimeters high. Associated shrubs include viscid rabbitbrush (Chrysothamnus viscidiflorus), shadscale (Atriplex confertifolia), and budsage (Artemisia spinescens). A generally sparse herbaceous layer is composed of squirreltail (Sitanion hystrix), Indian ricegrass (Oryzopsis hymenoides), rockcress (Arabi spp.), Hoods phlox (Phlox hoodii), and cushion buckwheat (Eriogonum ovalifolium). Cover data and shrub density are presented in Appendix A.

3.2.2 Big Sagebrush Type

This vegetation type occurs mainly on deep, gravelly loam soils on concave positions between alluvial fans. The dominant shrub is big sagebrush (Artemisia tridentata), which is often greater than 5 decimeters in height. Commonly associated shrubs include shadscale (Atriplex confertifolia) and viscid rabbitbrush (Chrysothamnus viscidiflorus). The herbaceous layer is dominated by grasses such as squirreltail, Sandbergs bluegrass (Poa secunda), and Indian ricegrass. Forbs are very sparse and infrequently encountered. Cover data and shrub density are presented in Appendix A.

3.2.3 Saltbush Type

This type is dominated by sickle saltbush (Atriplex falcata), which occurs on loamy soils, generally within ephemeral floodplains. The shrub stratum is very low, generally less than 2 decimeters. The herbaceous layer is dominated primarily by squirreltail and Indian ricegrass. Cover data and density data are presented in Appendix A.

3.2.4 Shadscale Type

This type, which is similar to the Saltbush type, is dominated by shadscale. Additionally, the Shadscale type generally occurs on the floodplains of ephemeral drainages which are located in topographically higher positions. The shrub canopy is usually less than 3 decimeters in height. The understory is composed of squirreltail, Indian ricegrass, and Sandbergs bluegrass. Cover data and density data are presented in Appendix A.

3.2.5 Winterfat Type

This vegetation type, which is dominated by winterfat (Ceratoides lanata), occurs as small inclusions within the Big Sagebrush type. Other plant species which are associated with this type include budsage (Artemisia spinescens), squirreltail, Indian ricegrass, and tansy mustard (Descuriania supp.). Total plant cover was estimated to range from 25 to 40 percent.

3.2.6 Rabbitbrush Type

This type is dominated by viscid rabbitbrush and occurs on gravelly soils and substrates. It is largely a transitional vegetation type which occurs on topographic positions between the Big Sagebrush and Black Sagebrush types. Associated species include squirreltail, Indian ricegrass, shadscale, big sagebrush, and black sagebrush. Vegetative cover was estimated to range from 35 to 40 percent.

3.2.7 Crested Wheatgrass Type

Created wheatgrass (Agropyron crisatum) was planted in the northwestern portion of the plant site area. Most of the associated plants appear to be invading from adjacent communities with big sagebrush being the primary invader. Total vegetative cover was estimated to range between 30 and 40 percent.

3.2.8 Riparian Type

To be described after survey to be conducted in June 1989.

3.3 VEGETATIVE COMMUNITIES IN SNAKE MOUNTAINS

Four major vegetation types were identified as occurring on the Snake Mountain exchange lands area. These types include Mountain Brush Low Sagebrush, Big Sagebrush/Bluebunch Wheatgrass, and Riparian types. Descriptions of each type are included in Appendix A.

3.4 RARE PLANTS

Rare plant species with potential to occur in the regional area surrounding the proposed project area are listed in Table 3-1. Current status, i.e., federal and state status, is also included in Table 3-1.

Arabis facifructa is known to occur in two locations in Elko County and in one location in Nye County. These are the only known populations of the species. The habitat is in crevices of rocks within sagebrush communities. The type collection was located on a high ridge. The area north of the study area where the species was originally identified (Rollins 1982) was intensively searched, but no populations were located. The species was not found in the study areas.

Collomia renacta is a recently described species that is only known from Malheur County, Oregon and Elko County, Nevada. The habitat is on

Table 3-1. RARE PLANT SPECIES AND PRESENT RECOMMENDED STATUS

Taxon	Status[1] Fed. Reg.	NNPS
Arabis facifructa	C2	C2
Collomia renacta	2*	C2
Cryptantha interrupta	3C	D
Lepdium nanum	3C	D
Thelypodium sagittatum ssp. ovalifolium	3C	D

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[1] Federal Register (Fed. Reg.) Categories: C2 - Candidate 2, USFWS: need more information before listing; 3C - taxa are more widespread than originally thought and/or have no identifiable threat.

Nevada Native Plant Society (NNPS) Categories: C2 - Same as Federal Register; D - Plants deleted from list because they have been found to be more common than originally believed.

2* - Newly described species

relatively undisturbed, rocky, south-facing slopes of lands commonly referred to as "scablands." Elevations range from 1500 to 2300 meters. Associated species include *Balsamorhiza sagittata*, *Castilleja chromosa*, *Crepis modocensis*, *Chrysothamnus nauseosus*, *Delphinium andersonii*, *Eriogonum caespitosum*, and *Gilia sinuata*. Potential habitat for this species occurs on the exchange lands but not on the plant site. No populations of this species were found.

Cryptantha interrupta is widely distributed and is known to occur in Elko, Eureka, Nye, and White Pine counties, Nevada and in Cassia County, Idaho. The habitat is rocky hillsides with sandy or clayey soils within a sagebrush or pinyon-juniper community. The elevation ranges from 4900 to 7900 feet. Flowering is from May to June. Habitat for this species occurs in the plant site but not in the exchange lands. No populations were found in the study areas.

Lepidium nanum is known from Elko, Eureka, White Pine, and Nye counties, Nevada. The habitat is rocky hillsides, calcareous hills, white alkaline clay hills, alkaline flats and white calcareous clay knolls within a sagebrush, desert shrub, or pinyon-juniper types. Elevations range from 5000 to 6500 feet. The species flowers from May to June. This species was found in the vicinity of the plant site.

Of the species listed in Table 3-1, only *Lepidium nanum* was identified in the GAI. Over 200 plants were found just north of Toano Well No. 1 within an area about 150 by 300 feet in dimensions. However, as noted in Table 3-1, the species has been deleted from the Northern Nevada Native Plant Society list and has a federal status of 3C (taxa are more widespread than usually thought and have no identifiable threat).

Thelypodium sagittatum var. ovalifolium is known from Elko and White Pine counties, Nevada; and Garfield, Iron, Juab, and Kane counties, Utah. Habitat is clayey soils around springs, streams, or lakes. Associated plants commonly include Elymus cinerous, Urtica diocia, Solidago spectabilis, Rosa woodsii, and Castilleja exilis. The elevation ranges from 6000 to 8400 feet. Flowering occurs from May to July. While potential habitat occurs in the exchange lands, no populations were identified.

SECTION 4

4.0
AFFECTED ENVIRONMENT FOR WILDLIFE AND AQUATIC RESOURCES

4.1 METHODOLOGY

Information used to describe wildlife and aquatic resources consisted of data from literature, personal agency communications, various reconnaissance surveys, and helicopter overflights. The aerial grid pattern flown was every ½ mile extending in an east-west direction. Data from these sources were qualitatively evaluated, integrated, and used to develop the description of existing conditions. The data base was also reviewed to verify that data were recent enough to reflect current conditions. If the information was not considered current and representative of current conditions, field checks and/or field surveys were conducted. A summary and schedule for field investigations conducted to date is presented in Table 4-1.

Wildlife and aquatic resources are first discussed below for the land exchange area and then for specific project components within the GAI. General information regarding distributions, relative abundance, and habitat requirements is presented in Appendix A for various wildlife species defined as unique and/or highly valued. Wild horses are not addressed in the following discussion, because the nearest herd is located in the Pilot Range and, therefore, would not be impacted by the proposed TSPP (Portwood 1989).

Within the federal selected lands in Toano Draw and the private offered lands in the Snake Mountains, several categories of wildlife habitat exist. These are summarized in Table 4-2. More detailed descriptions of these habitat types and utilization by wildlife species is provided below.

Table 4-1. TYPE AND TIME PERIOD OF BIOLOGICAL SURVEYS PERFORMED ON THOUSAND SPRINGS PROJECT SITE 1981-1988

Plant Site & Parcels Adjacent	
• Sage Grouse Surveys:	
4 hours aerial survey	April 1981
3 hours aerial survey	April 1986
3 hours aerial survey	March 1987
2 hours aerial survey	April 1988
1 day ground truthing	May 1982
1 day ground truthing	March 1987
• Songbird/Nongame Bird Surveys:	
2 consecutive mornings Emlen transects	July 1986
3 consecutive mornings Emlen transects	October 1986
3 consecutive mornings Emlen transects	January 1987
1 morning Emlen transects	May 1987
3 consecutive mornings Emlen transects	June 1988
• Big Game Surveys	
1 day driving transect (including eastern site parcels and Gamble Ranch)	February 1986
1 day driving transect	May 1986
1 day driving transect	October 1986
1 day driving transect	May 1987
4 hours aerial survey	January 1987
Update migration route map data	July 1988
Opportunistic sightings throughout study period on entire site	
• Small Mammal Trapping	
540 trap nights at four locations in 4 different habitat types within and adjacent to plant site; 3 days	January 1987
540 trap nights at four locations in 4 different habitat types within and adjacent to plant site; 3 days	May 1987
21-Mile Reservoir/Marsh	
• Waterfowl/Shore Bird Surveys	
1 morning ground observations	February 1986
1 morning ground observations	May 1986
1 morning ground observations	October 1986
1 morning ground observations	May 1987
1 hour aerial survey	May 1986
3 consecutive mornings ground observations	June 1988

Table 4-1. TYPE AND TIME PERIOD OF BIOLOGICAL SURVEYS PERFORMED ON THOUSAND SPRINGS PROJECT SITE 1981-1988 (continued)

3 consecutive mornings ground observations	July 1988
Dake Reservoir	
• Waterfowl/Shorebird Surveys	
3 consecutive mornings ground observations	May 1982
1 afternoon ground observations	February 1986
1 hour aerial survey	May 1986
3 consecutive mornings ground observations	July 1988
Crittenden Reservoir	
• Waterfowl/Shorebird Surveys	
3 consecutive mornings ground observations	May 1982
1 hour aerial survey	May 1986
3 consecutive mornings ground observations	July 1988
Winecup Ranch Marsh Area	
• Waterfowl/Shorebird Surveys	
1 morning ground observations	February 1986
3 consecutive mornings ground observations	May 1986
1/2 hour aerial survey	May 1986
1 morning ground observations	July 1986
1 morning ground observations	October 1986
3 consecutive mornings ground observations	June 1987
• Songbird/Nongame Bird Surveys	
1 morning ground observations	February 1986
3 consecutive mornings ground observations	May 1986
3 consecutive mornings Emlen transects	July 1986
1 morning ground observations	October 1986
1 morning ground observations	January 1987
1 morning ground observations	May 1987
3 consecutive mornings ground observations	June 1988
Thousand Springs Creek, East of Highway 93	
• Waterfowl Surveys	
3 days consecutive ground observations	May 1982
2 hours aerial surveys	May 1986
• Songbird/Nongame Bird Surveys	
3 days consecutive ground observations	May 1982
1 day ground observations	February 1986

Table 4-1. TYPE AND TIME PERIOD OF BIOLOGICAL SURVEYS PERFORMED ON THOUSAND SPRINGS PROJECT SITE 1981-1988 (concluded)

1 day ground observations	May 1986
2 consecutive mornings ground observations	July 1986
1 morning ground observations	October 1986
3 consecutive mornings ground observations	May 1987
3 consecutive mornings ground observations	June 1988
• Raptor Surveys (Nesting & Success)	
3 days ground observations	May 1982
2 days ground observations	February 1986
1 day ground observations	May 1986
1 day ground observations	October 1986
1 morning ground observations	May 1987
3 consecutive days ground observations	June 1988
• Sage Grouse Brooding Success	
3 consecutive mornings ground observations	July 1986
3 consecutive mornings ground observations	June 1988
Loomis Creek	
• Fisheries Species Composition and Abundance Surveys Shocked 3 stations on a 1,000 foot reach just above confluence with Thousand Springs Creek; 2 days	July 1986
Thousand Springs Creek	
• Fisheries Species Composition and Abundance Surveys Shocked 7 stations along an estimated 20 miles of Thousand Springs Creek from confluence with Loomis Creek, downstream to 21-Mile Reservoir; 3 days	July 1986
Cold Springs Creek	
• Fisheries Species Composition and Abundance Surveys Shocked 3 stations along a 1 1/2 mile reach from headwaters downstream; 1 day	October 1986
Dake Reservoir	
• Fisheries Species Composition and Abundance Surveys Summarized information collected by Nevada Department of Wildlife;	August 1988

Table 4-2. SUMMARY OF TYPES AND APPROXIMATE AMOUNTS OF WILDLIFE HABITAT WITHIN THE EXCHANGE LANDS

Habitat Type	Federal Selected Lands	Private Offered Lands
Mule Deer Yearlong	4377 acres	0 acres
Mule Deer Winter	459 acres	0 acres
Mule Deer Summer	0 acres	11,241 acres
Antelope Winter	955 acres	0 acres
Antelope Summer	12,536 acres	13,335 acres
Elk Summer	493 acres	0 acres
Elk Winter	986 acres	0 acres
Sage Grouse Lek	3 leks	0 leks
Sage Grouse Brooding Ground	462 acres	0 acres
Sage Grouse Winter	1063 acres	0 acres
Loomis Creek (Coldwater Fishery)	0 miles	4.6 miles
Pole Creek (Coldwater Fishery)	0 miles	2.3 miles
Cold Springs Creek (No Fishery)	0 miles	1.2 miles

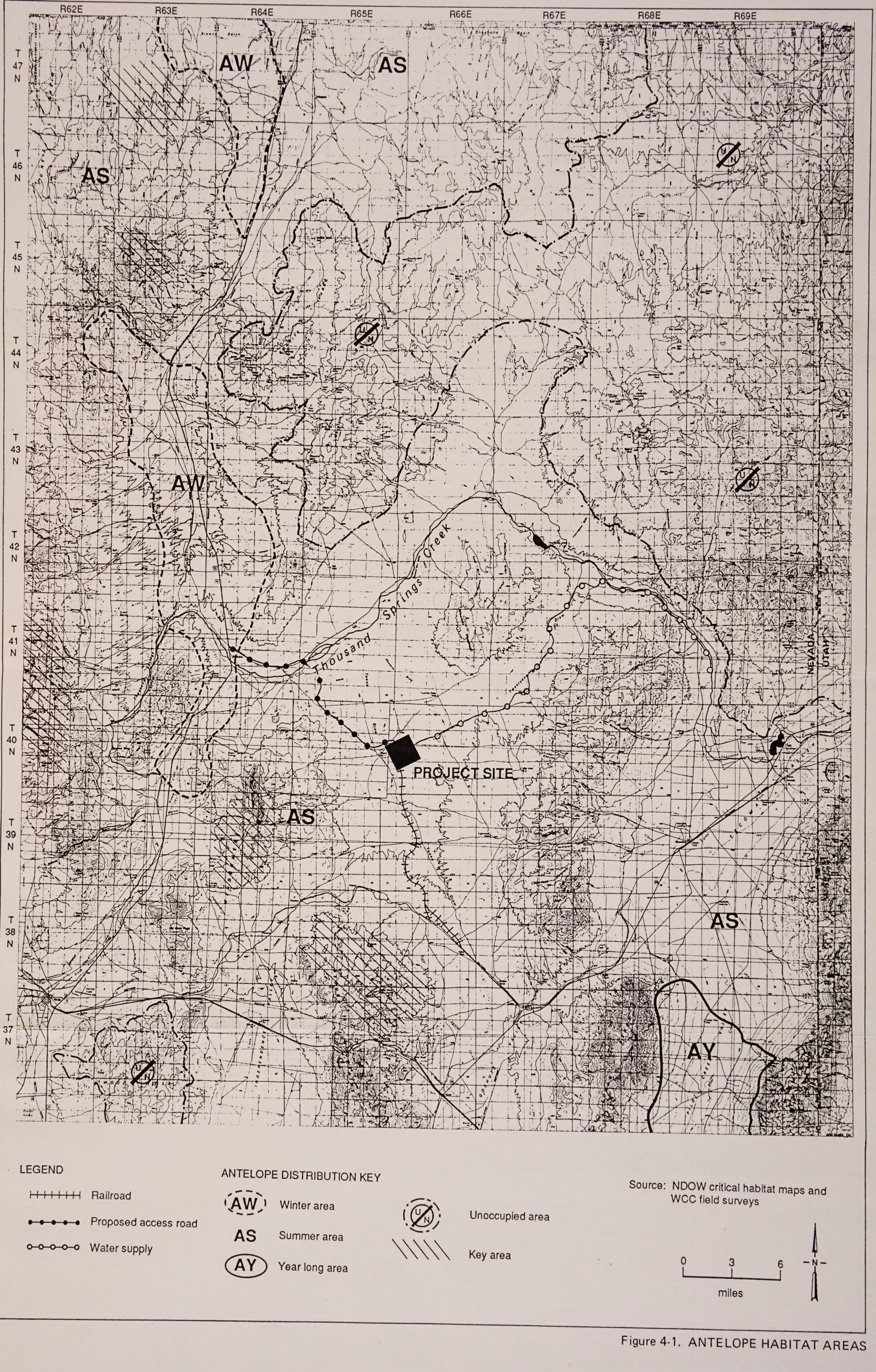
4.2 UNIQUE AND/OR HIGHLY VALUED WILDLIFE SPECIES

4.2.1 Antelope

Antelope occupy the arid grass areas within the GAI including the plant site, utility corridors, exchange lands, and adjacent areas potentially affected by indirect impacts. Currently, Toano Draw is a fawning area for a limited number of does. Solitary bucks have been observed throughout Toano Draw (Nevada Dept. of Wildlife (NDOW) 1989; WCC 1981 through 1988). A rough estimate for the number of antelope occupying the Red Point, Oasis, Toano Draw, Pilot Valley, and Pequop areas is approximately 510 animals (Williams 1989; NDOW 1989). Approximately 50 antelope have been released at three sites located in the areas between Windermere Hills, North Pequop Mountain Range, and North Toano Mountain Range (Williams 1985). A new reestablishment effort in conjunction with the BLM and NDOW has been planned for 1989 with approximately 50 animals with an ultimate goal of 300 animals. Also, a proposed reestablishment effort is underway and the release site will be in the Rock Springs Creek drainage, north of Eccles Ranch (BLM 1988; Lister 1989). Antelope concentration areas within the GAI include the Pilot Valley area east of Highway 93 and the Jarbidge and Salmon Falls area west of Highway 93. The Toano Draw area is limited for antelope production by the small amount of water available. Year-long, winter, and summer habitat areas are presented on Figure 4-1.

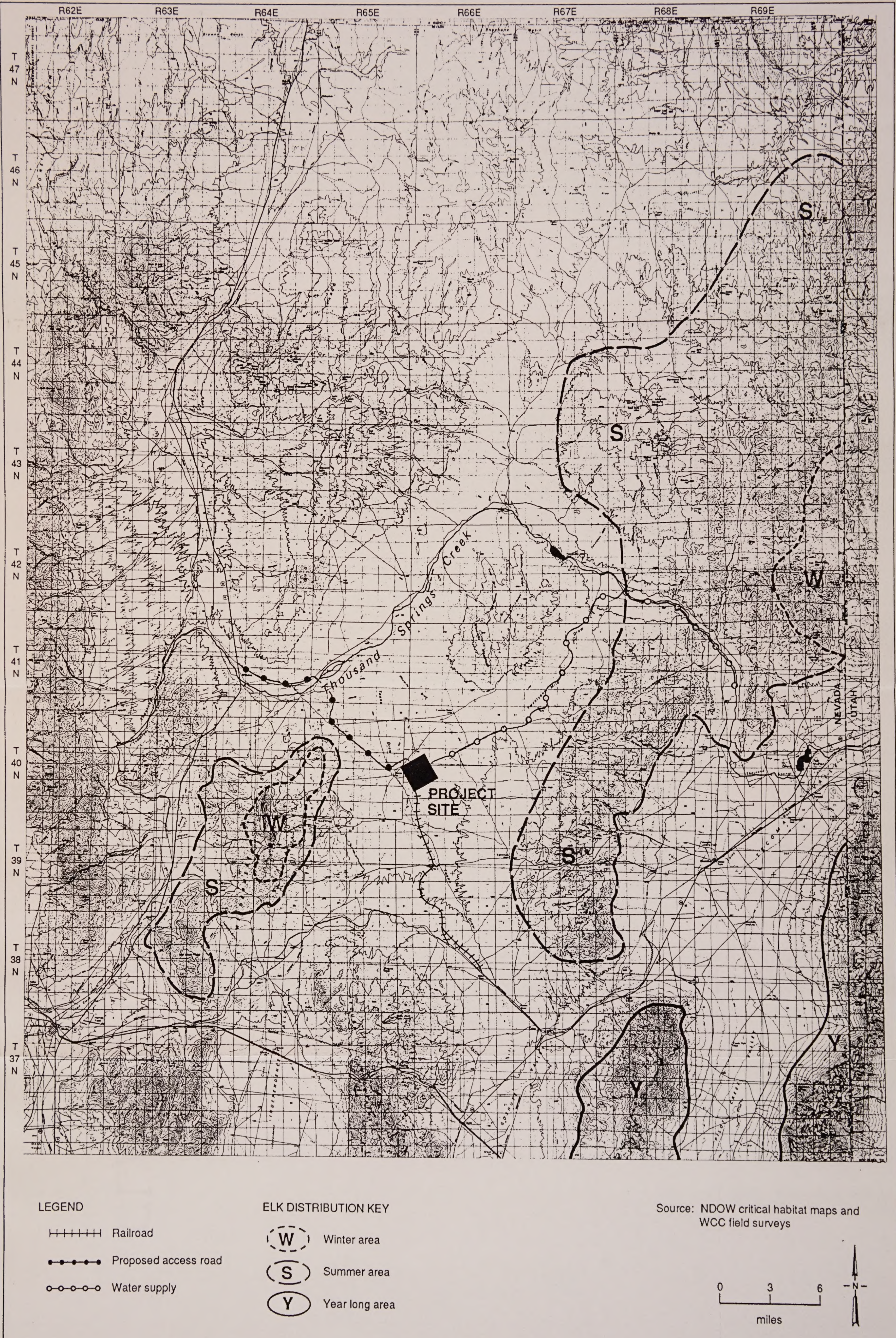
4.2.2 Elk

Elk concentration areas within the GAI are primarily within the Pilot Peak and Crittenden/Twelve Mile Ranch areas (Figure 4-2). Herd production of these two areas has been very successful. Approximately 40 to 50 elk were introduced in the Pilot Mountains as a result of a program managed by the State of Utah. That herd now numbers approximately 250. Pioneering populations of elk are known to occur elsewhere within the GAI. The total elk population within the GAI is currently approximately 430 animals (NDOW 1989). Elk in proximity to the Gamble Ranch alfalfa fields are often found



Source: NDOW critical habitat maps and WCC field surveys

Figure 4-1. ANTELOPE HABITAT AREAS



Source: NDOW critical habitat maps and WCC field surveys

Figure 4-2. ELK HABITAT AREAS

foraging in that area. Field observations of elk were made during big game overflights in 1986 (WCC 1986). In addition, NDOW personnel have made several field observations throughout the area during routine big game population studies. No elk were observed in the area of the proposed plant site.

4.2.3 Mule Deer

Mule deer are the most abundant big game species in the GAI and occupy a great variety of habitat types. Field observations were made on several occasions in the vicinity of Twelve Mile Ranch (February 1986, January 1987, and June 1988) (Figure 4-3).

The GAI is located within NDOW's mule deer hunting units 7 and 8, which encompass approximately 3,000,000 acres. These two hunting units provide habitat for approximately 35,600 deer in the pre-hunt season (NDOW 1989). The number of acres in the GAI is approximately 2,080,000. Assuming a linear correlation between habitat and deer numbers within the GAI, approximately 23,000 deer may occur in the GAI. Habitat areas, migration corridors, and use areas are shown on Figure 4-3.

4.2.4 Bighorn Sheep

Bighorn sheep have recently been reestablished to the GAI. In 1987, approximately 20 animals were placed in the Pilot Mountain area. During the winter of 1989, 25 sheep were reestablished on L&D Mountain.

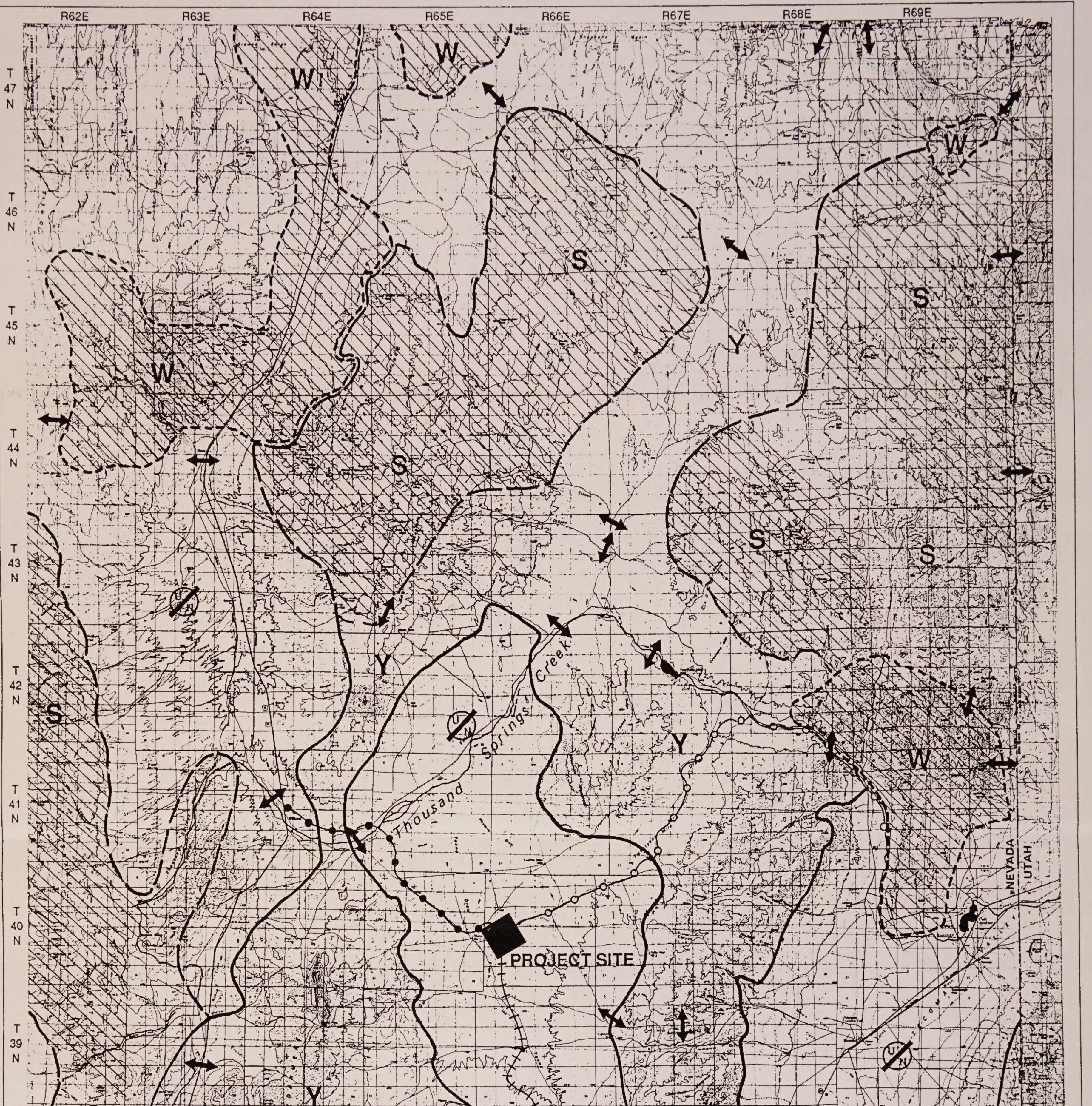
4.3 SMALL- AND MEDIUM-SIZED MAMMALS

River otters were observed in July 1988 in Twentyone Mile Reservoir. Other furbearers which may occur within the GAI include beaver, muskrat, mink, skunk, and badger. Muskrats were observed on a number of occasions along Thousand Springs Creek. Coyotes are found throughout all habitats in Nevada, although they are most common in the grasslands (Findley et al. 1975). Mammal species potentially occurring and observed within the study area are provided in Table 4-3.

4.4 RAPTORS

In general, raptors have rather broad areal distributions, even though certain species are commonly associated with specific vegetation types. Raptor species reported to occur in the proposed project area include the golden eagle, ferruginous hawk, peregrine falcon, prairie falcon, marsh hawk, and red-tailed hawk, among others (Table 4-4). The mountains, canyons, and riparian habitat associated with the TSPP project area provide suitable nesting habitat for a number of raptors.

Thirteen raptorial species were observed using the various vegetations associations within the GAI. Some species are considered permanent while others either only breed or winter in the region. Species observed nesting within the study area include the golden eagle, marsh hawk, and long-eared owl. A golden eagle nest was located south of Schoolhouse Canyon during the ground survey of May 13, 1982. In addition, two marsh hawk nests were observed in Winecup Marsh. Raptor surveys conducted in 1988 revealed several empty nests in cliff areas throughout areas adjacent to the Winecup Ranch; however, no active nests were sighted. A long-eared owl nest was found in the Willow riparian area west of Winecup Ranch. A sharp-shinned hawk was also seen in the area but no nest could be found. An osprey was observed 3 times during the study period in the Twentyone Mile Reservoir area. Osprey have also been observed at Crittenden Reservoir, Dake Reservoir, and along U.S. Highway 93 near the Winecup Ranch (Lister 1989). No osprey nesting sites were located. In addition, other species, including red-tailed hawk, prairie falcon, and kestrel, may nest in these areas; however, none were observed nesting. There is a potential bald eagle nest site at Salmon Falls Creek (Lister 1989).



Source: NDOW critical habitat maps and WCC field surveys

Figure 4-3. MULE DEER HABITAT AREAS

Table 4-3. MAMMAL SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

Species	Common Name	Observed	Habitat Type	Relative Abundance
Family: Soricidae	(Shrews)			
Sorex merriami	Merriam's Shrew		SB	
Sorex vagrans	Vagrant Shrew		R	A
Sorex palustris	(Northern) Water Shrew		R,M	
ORDER: Chiroptera	(Bats)			
Myotis lucifugus	Little brown Myotis		R	A
Myotis evotis	Long-eared Myotis		M	
Myotis volans	Long-legged Myotis		M	
Myotis leibii	Small-footed Myotis		M	
Eptesicus fuscus	Big Brown Bat		M	C
Plecotus townsendii	Townsend's Big-eared Bat		M	
Eaderma maculatum	Spotted Bat			U
Family: Procyonidae	(Racoon)			
Procyon lotor	Racoon		Ag,M, R	C
Family: Mustelidae	(Weasels, Skunks, Badgers, Otters and Allies)			
Mustela erminea	Ermine		M,R	C
Mustela frenata	Long-tailed Weasel		M,R,Ag	
Mustela vison	Mink		R	
Taxidea taxus	Badger		Ag	C
Spilogale putorius	Western Spotted Skunk		M	C
Mephitis mephitis	Striped Skunk		SB	
Lutra canadensis	River Otter	X	R	
Family: Canidae	(Dogs)			
Canis latrans	Coyote	X	SB,R,M,Ag	A
Vulpes vulpes	Red Fox		M	U
Vulpes velox	Kit Fox		Ag, SB	
Urocyon cinereoargenteus	Gray Fox		M	
Family: Felidae	(Cats)			
Felis concolor	Mountain Lion		M	U
Felis rufus	Bobcat		M	

Table 4-3. MAMMAL SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA (continued)

Species	Common Name	Observed	Habitat Type	Relative Abundance
Family: Sciuridae	(Squirrels)			
Eutamias minimus	Least Chipmunk	X	SB,Ag,M	
Eutamias dorsalis	Cliff Chipmunk		M	
Eutamias umbrinus	Colorado Chipmunk		M	
Eutamias amoenus	Yellow-Pine Chipmunk		M	
Marmota flauiventris	Yellow-bellied Marmot		M	C
Spermophilus townsendii	Townsend's Ground Squirrel		SB	
Spermophilus richardsonii	Richardson's Ground Squirrel	X	Ag	
Spermophilus beldingi	Belding's Ground Squirrel		Ag	
Spermophilus lateralis	Golden-mantled Ground Squirrel		M	
Ammospermophilus leucurus	White-tailed Antelope Squirrel		SB,Ag	
Family: Geomyidae	(Pocket Gophers)			
Thomomys bottae	Botta's Pocket Gopher		M,R	
Thomomys talpoides	Northern Pocket Gopher		Ag, R, M	
Family: Heteromyidae	(Pocket Mice)			
Perognathus longimembris	Little Pocket Mouse		SB	
Perognathus parvus	Great Basin Pocket Mouse	X	SB,Ag,M	
Microdipodops megacephalus	Dark Kangaroo Mouse		SB,R	
Dipodomys ordii	Ords Kangaroo Rat	X	SB	
	Great Basin Kangaroo Rat			
Family: Castoridae	(Beaver)			
Castor canadensis	Beaver		R	
Family: Cricetidae	(New World Rats and Mice)			
Reithrodontomys megalotis	Western Harvest Mouse		R,Ag	
Peromyscus maniculatus	Deer Mouse	X	SB,Ag,M,R	
Peromyscus crinitus	Canyon Mouse		M	
Peromyscus truei	Pinyon Mouse		M	
Onychomys leucogaster	Northern Grasshopper Mouse	X	Ag,SB	
Neotoma lepida	Desert Woodrat		SB	
Neotoma cinerea	Bushy-tailed Woodrat		M	
Microtus montanus	Mountain Vole		M,R,Ag	
Microtus longicaudus	Long-tailed Vole		M,Ag	
Lagurus curtatus	Sagebrush Vole		SB	
Ondatra zibethicus	Muskrat	X	R	
Family: Muridae	(Old World Rats and Mice)			
Mus musculus	House Mouse		Ag	

Table 4-3. MAMMAL SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA (concluded)

Species	Common Name	Observed	Habitat Type	Relative Abundance
Family: Zapodidae	(Jumping Mice)			
Zapus princeps	Western Jumping Mouse		Ag,R	
Family: Erethizontidae	(New World Porcupines)			
Erethizon dorsatum	Porcupine		M	
Family: Leporidae	(Rabbits)			
Lepus townsendii	White-tailed Jackrabbit	X	Ag,SB	
Lepus californicus	Black-tailed Jackrabbit		Ag,SB,R	
Sylvilagus idahoensis	Pygmy Rabbit		SB	
Sylvilagus nuttallii	Mountain Cottontail		M,Ag,R	
Family: Cervidae	(Cervids)			
Odocoileus hemionus	Mule deer	X	M,R	
Cervus elephus	Elk	X	M	
Family: Antilocapridae	(Pronghorn)			
Antilocapra americana	American Antelope	X	SB,Ag	

Sources: Hall 1946; Audubon Society 1980.

Table 4-4. BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA

	Species	Common Name	Habitat Type	Observed
Order:	**Podicipediformes**			
Family:	Podicipedidae	(Grebes)		
	Podiceps nigricollis	Eared Grebe	Rv	X
	Podilymbus podiceps	Pied-billed Grebe	Rv, M	X
Order:	**Pelecaniformes**			
Family:	Pelecanidae	(Pelicans)		
	Pelecanus erythrorhynchos	American White Pelican	Rv	X
Family:	Phalacrocoracidae	(Cormorants)		
	Phalacrocorax auritus	Double-crested Cormorant	Rv, M	X
	Ardea herodias	Great Blue Heron	M	X
	Bubulcus ibis	Cattle Egret	A	X
	Casmerodius albus	Great Egret	M, A	X
	Egretta thula	Snowy Egret	M, A	X
	Nycticorax nycticorax	Black-crowned Night Heron	M, WR	X
	Botaurus lentiginosus	American Bittern	M	X
Family:	Threskiornithidae	(Ibises)		
	Plegadis chihi	White-faced Ibis	Rv, A	X
Order:	**Anseriformes**			
Family:	Anatidae	(Swans, Geese, Ducks)		
	Olor buccinator	Trumpeter Swan		
	Branta canadensis	Canada Goose	Rv, M, C	X
	Anas platyrhynchos	Mallard	M, C, Rv	X
	Anas strepera	Gadwall	M, C, Rv	X
	Anas acuta	Northern Pintail	M, C, Rv	X
	Anas crecca	Green-winged Teal	Rv, M	X
	Anas discors	Blue-winged Teal	Rv, M	X
	Anas cyanoptera	Cinnamon Teal	Rv, M	X
	Anas americana	American Wigeon	M	X
	Anas clypeata	Northern Shoveler	M	X
	Aythya americana	Redhead	M, Rv	X
	Aythya valisineria	Canvasback	M, Rv	X
	Aythya affinis	Lesser Scaup	Rv	X
	Bucephala albeola	Bufflehead		X
	Oxyura jamaicensis	Ruddy Duck	M, Rv	X

Table 4-4. BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA (continued)

	Species	Common Names	Habitat Type	Observed
	Mergus merganser	Common Merganser	C	X
	Bucephala clangula	Common Goldeneye		X
Order:	**Falconiformes**			
Family:	Cathartidae	(Vultures)		
	Cathartes aura	Turkey Vulture	SB	X
Family:	Accipitridae	(Hawks, Eagles)		X
	Accipiter striatus	Sharp-shinned Hawk	WR	X
	Cirus cyaneus	Northern Harrier	M, Rv, WR	X
	Buteo jamaicensis	Red-tailed Hawk	A, M, SB	X
	Buteo swainsoni	Swainson's Hawk		X
	Buteo lagopus	Rough-legged Hawk		X
	Buteo regalis	Ferruginous Hawk		X
	Aquila chrysaetos	Golden Eagle	SB	X
	Haliaeetus leucocephalus	Bald Eagle		
Family:	Pandionidae	(Osprey)		
	Pandion haliaeetus	Osprey		X
Family:	Falconidae	(Falcon)		
	Falco mexicanus	Prairie Falcon	SB	X
	Falco peregrinus	Peregrine Falcon	A/M	X
	Falco sparuerius	American Kestrel	A, C, MSB	X
Order:	**Galliformes**			
Family:	Tetraonidae	(Grouse)		
	Centrocercus urophasianus	Sage Grouse		X
Family:	Phasianidae	(Quail, Pheasants, Partridges)		
	Lophortyx californicus	California Quail		
	Alectoris chukar	Chukar		
Order:	**Gruiformes**			
	Gruidae	(Cranes)		
	Grus canadensis	Greater Sandhill Crane	A, M	X
Family:	Rallidae	(Rails, Gallinules, Coots)		
	Rallus limicola	Virginia Rail		
	Porzana carolina	Sora Rail	M	X
	Fulica americana	American Coot	Rv, M	X

Table 4-4. BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA (continued)

	Species	Common Names	Habitat Type	Observed
Order:	**Charadriiformes**			
Family:	Charadriidae	(Plovers)		
	Charadrius vociferus	Killdeer	A, M, WR	X
Family:	Phalaropodidae	(Phalaropes)		
	Steganopus tricolor	Wilson's Phalarope	A, M	X
Family:	Recurvirostridae	(Avocets)		
	Recurvirostra americana	American Avocet	M	X
Family:	Scolopacidae	(Woodcocks, snipe, sandpipers)		
	Capella gallinago	Common Snipe	M	X
	Numenius americanus	Long-billed Curlew	M, WR	X
	Actitis macularia	Spotted Sandpiper	A. M	X
	Tringa melanoleucus	Greater Yellow legs	A, M	X
	Catoptrophorus semipalmatus	Willet	A, M	X
	Calidris mauri	Western Sandpiper	A, M	X
	Limnodromus scolopsceus	Long-billed Dowitcher	A, M, WR	X
Order:	**Colubmiformes**			
Family:	Columbidae	(Pigeons & Doves)		
	Columba livia	Rock Dove	A	X
	Zenaida macroura	Mourning Dove	A, SB	X
Family:	Strigidae	(Owls)		
	Tyto alba	Barn Owl	A	X
	Bubo virginianus	Great-Horned Owl	A, WR	X
	Asio flammeus	Short-eared owl	WR	X
	Asio otus	Long-eared owl	WR	X
Order:	**Caprimulgiformes**			
Family:	Caprimulgidae	(Goatsuckers)		
	Chordeiles minor	Common Nighthawk	A, M, WR	

Table 4-4. BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA (continued)

	Species	Common Names	Habitat Type	Observed
Order:	**Apodiformes**			
Family:	Trochilidae	(Hummingbirds)		
	Selasphorus platycercus	Broad-Tailed Hummingbird	WR	X
Order:	**Coraciiformes**			
Family:	Alcedinidae	(Kingfishers)		
	Megaceryle alcyon	Belted Kingfisher	M	X
Order:	**Piciformes**			
Family:	Picidae	(Woodpeckers)		
	Colaptes auratus	Common Flicker	M	X
	Melanerpes lewis	Lewis Woodpecker	M	X
	Picoides pubescens	Downy Woodpecker	WR	X
Order:	**Passeriformes**			
Family:	Tyrannidae	(Fly catchers)		
	Tyrannus verticalis	Western Kingbird	WR	X
	Sayornis saya	Say's Phoebe	SB	X
	Contopus sordidulus	Western Wood-Pewee		
Family:	Alandidae	(Larks)		
	Eremophila alpestris	Horned Lark	SB	X
Family:	Hirundinidae	(Swallows)		
	Tachycineta thalassina	Violet-green Swallow	A, M	X
	Iridoprocne bicolor	Tree Swallow	A, M, WR	X
	Stelgidopteryx, ruficollis	Northern Rough-winged Swallow	A, M, WR	X
	Hirundo rustica	Barn Swallow	A, M, WR	X
	Petrochelidon pyrrhonota	Cliff Swallow		
Family:	Corviday	(Jays, Magpies, Crows)		
	Pica pica	Black-billed Magpie	A, M, SB, WR	X
	Corvus corax	Common Raven	A, C, M, SB, WR	X
	Corvus brachyrhynchos	Common Crow	A, C, WR	X
	Gymnorhinus cyanocephalus	Pinyon Jay	SB	X

Table 4-4. BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA (continued)

	Species	Common Names	Habitat Type	Observed
Family:	Troglodytidaeq	(Wrens)		
	Troglodytes aedon	House Wren	WR	X
	Telmatodytes palustris	Long-billed Marsh Wren	M	X
Family:	Mimidae	(Mockingbirds, thrashers)		
	Mimus polyglottos	Northern Mockingbird	A	X
	Oreoscoptes montanus	Sage Thrasher	SB	X
Family:	Turdidae	(Thrushes, Solitaires, Bluebirds)		
	Turdus migratorius	American Robin	A, WR	X
	Sialia currucoides	Mountain Bluebird	SB	X
	Myadestes townsendi	Townsend Solitaire	SB	X
Family:	Sylviidae	(Gnatcatchers, Kinglets)		
	Polioptila caerulea	Blue-gray Gnatcatcher	WR	X
Family:	Motacillidae	(Pipits)		
	Anthus spinoletta	Water Pipit	A, M	X
Family:	Laniidae	(Shrikes)		
	Lanius ludovicianus	Loggerhead Shrike	SB	X
Family:	Sturnidae	(Starlings)		
	Sturnus vulgarius	Starling	A, WR	X
Family:	Parulidae	(Warblers)		
	Dendroica petechia	Yellow Warbler	M, WR	X
	Dendroica coronata	Yellow-rumped Warbler	M, WR	X
	Oporornis tolmiei	MacGilivrary Warbler	WR	X
	Wilsonia pusilla	Wilson's Warbler	WR	X
Family:	Thraupidae	(Tanagers)		
	Piranga ludoviciana	Western Tanager	M, WR	X

Table 4-4. BIRD SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA (concluded)

Species	Common Names	Habitat Type	Observed
Family: Icteridae	(Meadowlarks, Blackbirds, Orioles)		
Dolichonyx oryziuorus	Bobolink	A, WR	X
Sturnella neglecta	Western Meadowlark	A, M, SB, WR	X
Xanthocephalus xanthocephalus	Yellow-headed Blackbird	A, M, WR	X
Agelalus phoeniceus	Red-winged Blackbird	A, M, WR	X
Icterus galbula	Northern Oriole	WR	X
Euphagus cyanocephalus	Brewer's Blackbird	A, M	X
Molothrus ater	Brown-headed Cowbird	WR	X
Family: Fringillidae	(Grosbeaks, Finches, Sparrows, Buntings)		
Pheucticus melanocephalus	Black-headed Grosbeak	WR	X
Passerina amoena	Lazuli Bunting	M	X
Carduelis psaltria	Lesser Goldfinch	WR	X
Chlorura chlorura	Green-tailed Towhee	SB	X
Passerculus sandwichensis	Savannah Sparrow	A, WR	X
Pooecetes gramineus	Vesper Sparrow	SB, WR	X
Amphispiza belli	Sage Sparrow	SB	X
Chondestes gramacus	Lark Sparrow	SB, WR	X
Spizella breweri	Brewer's Sparrow	SB, WR	X
Zonotrichia leucophyrs	White-crowned Sparrow	SB, WR	X
Melospiza melodia	Song Sparrow	M, SB	X
Passer domesticus	House Sparrow		X

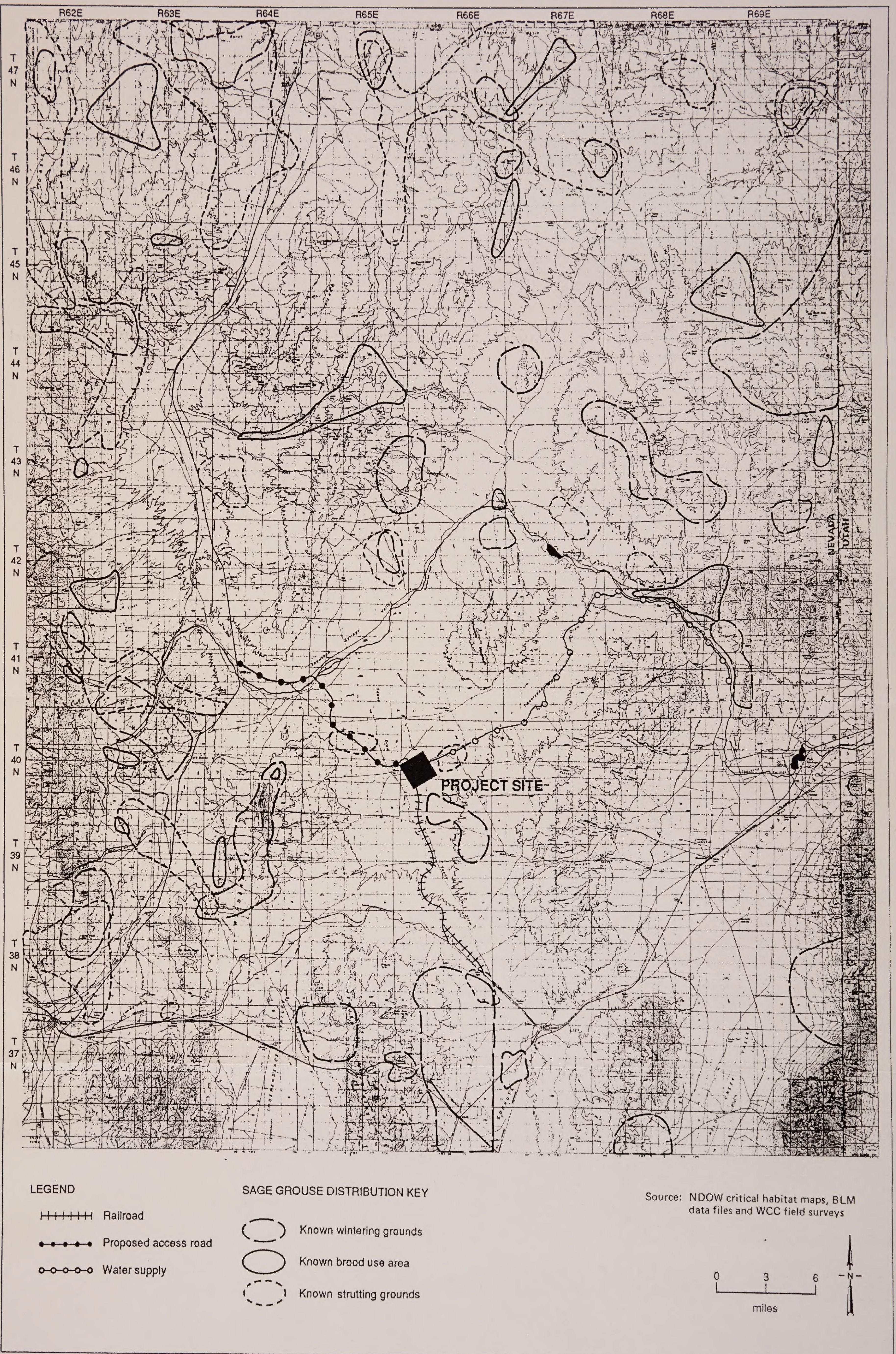
A = Agricultural/pasture land
C = Thousand Springs Creek
Rv = Reservoir
SB = Sagebrush/Uplands
WR = Willow Riparian

Source: Audubon Society 1983, 1977; Peterson 1961; BLM 1971; NDOW No date; Herron et al. 1985.

4.5 UPLAND GAME

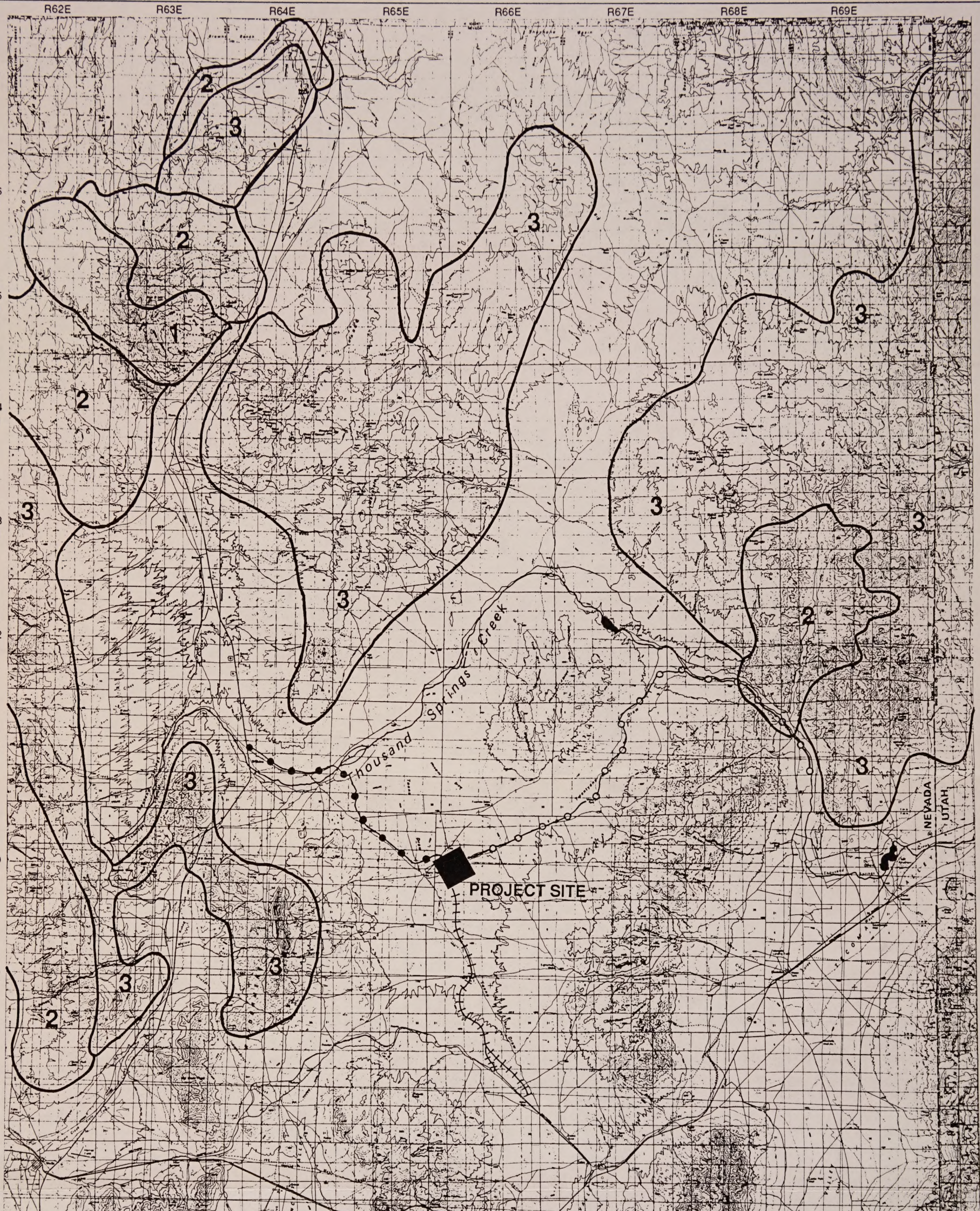
The sage grouse is an important upland species in the GAI and generally occurs in low sagebrush-dominated habitat. Riparian areas provide brooding habitat in late spring and early summer. There are no sage grouse winter grounds on the project site. Although no nesting or brooding habitats were located within a 2-mile radius of the proposed plant site, three strutting grounds are located within a 5-mile radius of the plant site (Figure 4-4). One area is located on the western border of Toano Draw (northwest of the proposed power plant), another area is within or very close to the proposed plant site, and the third area is located along the pipeline route from the Gamble wellfield. Thus, there may be some brooding activity near the plant area, as up to 80 percent of nesting/brooding areas occur within a 2- to 3-mile radius of leks (Lister 1989). However, winter habitat is located nearby in the southern portion of Toano Draw. The nearest nesting/brooding grounds were observed at the Thousand Springs Creek crossing at Winecup Ranch near Twelve Mile Ranch. Several helicopter overflights were conducted in the spring from 1981 through 1988 to locate sage grouse strutting grounds. During surveys from 1982 to 1987, one strutting ground (lek) was identified in the project area vicinity adjacent to the plant site (Figure 4-4). The number of birds present on the lek during these surveys ranged from 10 to 25. Additional information from NDOW indicates that two other strutting grounds are located near the project site (NDOW 1989). Other areas within the GAI where small concentrations of strutting birds were observed include a burned area to the northwest of the Winecup Ranch and some south-facing hill areas in the southeast of the Winecup Ranch. On a number of occasions, hens with chicks were observed in proximity to Thousand Springs Creek near the Winecup Ranch and Crittenden Creek confluence.

Chukar are also present in the GAI (Figure 4-5). However, in the areas that would be occupied by project components, chukar densities are low to nonexistent.



Source: NDOW critical habitat maps, BLM data files and WCC field surveys

Figure 4-4. SAGE GROUSE USE AREAS AND STRUTTING GROUNDS



Source: NDOW critical habitat maps and WCC field surveys

Figure 4-5. CHUKAR DENSITY

4.6 WATERFOWL/SHOREBIRDS AND OTHER WATERBIRDS

Several species of waterfowl and other waterbirds were identified in marsh lands and riparian areas primarily bounding the Thousand Springs drainage between Winecup Ranch and Dake Reservoir. These species were observed during aerial surveys and ground surveys from 1981 to 1988 (Table 4-4). In addition, data from NDOW and the BLM were collected. Species documented within the GAI include mallard, blue and green winged teal, shoveler, canvasback, coot, ruddy duck, gadwall, pintail, redhead, and merganser. Other water-type birds observed within the GAI include greater sandhill crane, great blue heron, white-faced ibis, rails, and phalaropes.

4.7 OTHER WILDLIFE SPECIES

Nongame birds, and amphibians and reptiles, potentially occurring within general habitat associations/communities in project area include the species such as larks, wrens, warblers, and sparrows (Table 4-4); and reptiles such as lizards and snakes.

4.8 AQUATIC SPECIES

The GAI includes a variety of waterbodies which are part of the Humboldt drainage originating in the Snake Mountains. The majority of these waterbodies are tributaries to or reservoirs on Thousand Springs Creek. These waterbodies contain a variety of habitat which varies with location and elevation. Fish populations include self-sustaining populations in the creeks and reservoirs and other populations maintained by stocking.

4.8.1 Loomis Creek

Loomis Creek is a small spring-fed creek originating in the Snake Mountains west of Wilkins, Nevada. Loomis Creek ends with its confluence with Thousand Springs Creek. Three locations were sampled in the creek. The upstream area was characterized by high gradient riffles and small pools. Overhead cover was abundant. Sediments included gravels and fines. Bank trampling and fines characterized much of this reach. Cattle grazing appeared to be responsible for these conditions. Beaver ponds were present downstream. Downstream glide and pool habitats were dominant. Substrates were comprised largely of gravels with small amounts of fines. Riparian cover was still relatively abundant in this area, but less so than upstream.

Bonneville redside shiners, brook trout, speckled dace, and Piute chub were found in Loomis Creek. Bonneville redside shiner and brook trout were found at all locations. However, speckled dace were the most abundant species.

Loomis Creek is the largest stream on the offered lands (BLM 1986). Based on field surveys conducted by the BLM, this stream had the highest estimated water quantity in the offered lands. The overall condition of the riparian/aquatic habitat was rated fair, primarily due to the livestock use of the area. Although the riparian areas could be improved, the fish and wildlife values were considered to be high. Streamside meadows in some areas have been created by beaver dams. Trout are believed to occur throughout most of Loomis Creek.

4.8.2 Thousand Springs Creek

Thousand Springs Creek was sampled at eight locations from upstream of Loomis Creek to near Dake Reservoir. The upper two stations in the vicinity of Loomis Creek were sampled as part of the Snake Mountain exchange lands. Sampling was conducted at eight locations to characterize aquatic habitats and fish populations. Upstream locations were characterized by glides and secondary pools. These habitats had cool water temperatures, narrow widths, relatively great overhead cover, and gravel substrates. Downstream, pool habitats became more abundant and greater percentages of fines were observed. Water temperatures generally increased at the downstream stations. Downstream of Twentyone Mile Reservoir, cover decreased, silts and fines increased, and depths became quite shallow.

Five species of fish were found in Thousand Springs Creek. Bonneville redside shiner and speckled dace were the two most common and widely distributed of the specifies found. Brook trout were primarily found near the confluence of Loomis Creek. However, one brook trout was found several miles downstream. Lahontan redside shiners were found between Red Point and Wilkins, Nevada. Utah chub were found between Twentyone Mile Reservoir and Dake Reservoir.

4.8.3 Twentyone Mile Reservoir

The Twentyone Mile Reservoir is located along Thousand Springs Creek upstream of Crittenden and Dake Reservoirs. It is a small reservoir used to provide temporary storage for irrigation and other agricultural uses for the Winecup Ranch. This reservoir is regularly drawn down completely.

Since Twentyone Mile Reservoir is only used for temporary storage, it cannot support permanent fish populations. It is likely that redside shiners and dace are present at certain times of the year due to washout from upstream habitats.

4.8.4 Dake Reservoir

Dake Reservoir has a surface area of 490 acres and a maximum depth of approximately 20 feet. Although Dake Reservoir receives surface water from Thousand Springs Creek and releases from Twentyone Mile, Eighteen Mile, and Crittenden Reservoirs, this reservoir is primarily supplied by groundwater discharges directly into the reservoir. The reservoir is formed by a 35.5-foot-high dam with a crest length of 2670 feet. Water depths vary from 5 to 20 feet. The reservoir is surrounded by alkaline remnant meadow with saltgrasses. The reservoir substrate consists of fines.

This reservoir has been stocked with northern pike and largemouth bass. These populations are now self-sustaining as is a population of Utah chub.

4.8.5 Crittenden Reservoir

Crittenden Reservoir is a 4300-acre-foot irrigation reservoir with a surface acreage of 360 acres and a maximum depth of 33 feet. The reservoir is partially filled each year and then drawn down to supply irrigation water. A series of springs provide water to the reservoir throughout the year, providing some limited recreational use. Bottom sediments consist primarily of fines.

This reservoir is annually stocked with catch-sized rainbow trout. Largemouth bass were introduced between 1965 and 1974 and are self-sustaining. Cutthroat trout are found but appear to be relatively rare. Utah chub were historically found in this reservoir but were removed by NDOW using chemical treatment methods in 1961.

4.8.6 Cold Springs Creek

Cold Springs Creek is a small tributary of Loomis Creek originating in the Snake Mountains. Two stations were sampled in this creek. Near the headwaters, riffle-pool-cascade habitats are present. Pools comprised over 55 percent of the stream habitat. Cobble and gravel substrates dominated. Riparian vegetation provided overhead cover. Downstream habitats were characterized by beaver ponds and low gradient riffles. Fines were the dominant substrates and little overhead cover was present in the area of the ponds. Further downstream overhead cover was more abundant and riffles and small pools were the dominant habitats. No fish were observed.

The BLM also inventoried the Cold Springs watershed and rated the overall riparian and aquatic condition as good. The fisheries values were rated low, primarily because of the small size. Abundant stands of aspen and mountain brush contribute to a moderate to high wildlife value.

4.8.7 Thermal Springs

A number of geothermally warmed springs occur along Thousand Springs Creek. These springs vary in temperature, amount of flow, and depth and areal extent of wetted habitat. Most habitat could be considered pool or glide.

4.8.8 Pole Creek Watershed (Eastern Slope)

This is the second largest creek in the offered lands (BLM 1986). Livestock use, erosion, decreased water table, and reduced riparian vegetation have contributed to low fish and wildlife values. The degradation of riparian vegetation, primarily aspens, has been exacerbated by beavers. During the 1986 BLM field assessment, no adult trout were observed in the creek, only young trout. Emigrations or low adult populations may account for the lack of adults. Pole Creek was rated as having poor recreational potential.

4.8.9 Pole Creek Watershed (Western Slope)

In areas where livestock graze, the habitat value was rated poor to fair by the BLM (1986); however, the riparian and aquatic condition is excellent in areas where there is no livestock. The water flow is low in some areas and, therefore, the fisheries and wildlife values in these locations range from low to moderate. In contrast, areas with suitable streamflow and ponds have excellent wildlife because of abundant water and associated stands of willows and aspens.

4.9 RARE, THREATENED, AND ENDANGERED SPECIES

A peregrine falcon was observed on May 11, 1982 in a pasture just west of the Winecup Ranch. This species is classified as a federally endangered species throughout its entire range as published in the Federal Register (35R 16047, October 13, 1970; 35FR 8495, June 2, 1970; and 35FR 18320, December 3, 1970). Because a peregrine falcon was observed only once during the course of field surveys between 1981 and 1988, the species is probably a migrant in the study area and not resident or nesting.

The range of Lahontan cutthroat trout (Salmo clarki henshawi), a federally threatened species, occurs within the GAI in Bettidge and Donner Creeks on the east slope of Pilot Mountains (Lister 1989); however, field investigations conducted during July 1986 in Loomis, Cole Springs, and Thousands Springs Creeks did not reveal the presence of this species. It is more commonly found in the Lahontan drainage, west of the Snake Mountains. Also, the Lahontan cutthroat trout is known to occur in 41 streams and potentially occurs in at least 20 streams in the Humboldt National Forest (U.S. Dept. of Agriculture [USDA] 1985). The known populations have been identified in the roadless areas of East Humboldt, Santa Rosa, Ruby Mountain, and Independence Mountain regions of the Humboldt National Forest.

A request will be made to the U.S. Fish and Wildlife Service (USFWS) for verification of federally threatened and endangered species in the project area. When a response is received, any additional species requiring evaluation will be addressed.

SECTION 5

5.0
ECOLOGICAL RESOURCES IMPACTS

5.1 LAND ACQUISITION

The land acquisition would result in an exchange of ecological resources associated with private and federal lands. The summary of types and amounts of wildlife habitat contained within the exchange lands is provided in Table 4-2. There would be a net gain in habitat for some target species and quality vegetation under BLM management, while other target species habitat would not longer be under BLM jurisdiction. No significant environmental consequences are expected.

5.2 CONSTRUCTION AND OPERATION

The potential impacts to ecological resources would be similar during the construction and operation phases of the proposed project. Therefore, impacts to vegetation and wildlife species during those phases will be addressed in this section. Potential impacts specific to either the construction or operation phases will be identified.

5.2.1 Vegetation

5.2.1.1 Indicators of Impact Significance. Potential impacts to vegetative resources include the following general categories:

- Disturbance to rare or unusual vegetation types of species
- Impacts on more common vegetation types
- Permanent loss of productive capacity (site quality) in any vegetation type

Areas that support unusual vegetation or very productive plant communities are important in maintaining both the animal and plant diversity of the region. For example, riparian communities are defined as unique and critically important because they provide unique structural habitat for wildlife and because they are the most productive habitat in the area. Impacts on such unique, rare, or critically important plant communities were considered significant. The duration of impacts to rare or unusual vegetation types was then estimated as short-term (less than 5 growing seasons) or long-term (greater than 5 years or 5 growing seasons).

The second general impact category, large-scale removal of more common vegetation types, was addressed by comparison to the total area of that type found in the region.

The final impact category, loss of productive capacity or site quality, is related to the size and duration of surface disturbances that leave soil exposed to erosion. Larger areas that would be repeatedly disturbed and not revegetated would suffer greater erosion and loss of production potential (per unit area) than similar sites where a smaller area is cleared for a shorter time.

5.2.1.2 Impacts to Vegetation.

Vegetation Removal. The most common impact due to construction of project components (plant site area and utility/access corridors) would be removal of vegetation. The majority of vegetation that would be removed consists of communities common in the region.

Approximately 1780 acres of vegetation (1216 AUMs) would be removed in the plant site area due to construction of the plant, construction-worker camp, wastewater ponds, storage areas, and other ancillary facilities. The majority of the vegetation removed would consist of black sagebrush, shadscale, saltbush, and big sagebrush. This impact is considered long-term because vegetation would not recover during the life of the project (approximately 60 years). Although this loss of vegetation would be adverse and long-term, it would not be a significant impact to animal or plant habitat, game, or livestock production because the loss would be insignificant in comparison to regional quantities of similar vegetation.

The quantities of vegetation that would be affected by construction of railroad access, road access, and water pipelines are 260, 120, and 160 acres, respectively. Not all of this total would actually be removed. Some would be crushed or otherwise damaged by movement of vehicles and construction materials.

With the exception of one access road crossing on the Thousand Springs drainage near Winecup Ranch, none of the affected vegetation types are unique in the regional area and would represent a relatively small percentage of regional vegetation. If properly prepared and seeded, areas where vegetation was removed by construction activities should be revegetated by perennial plants within 5 years. If disturbed areas are not properly reclaimed, recovery may not occur for 20-30 years because of the soils, climate, and slow recovery of native species in the project area. Appropriate mitigation is described below.

As noted above, the road crossing of Thousand Springs near Winecup Ranch has potential for disturbance of riparian vegetation during construction. The total area of wetland vegetation affected (assuming a 100-foot-wide corridor of disturbance) would be approximately 2.25 acres. Approximately half of the acreage that would be distrubed is classified as a graminoid complex comprised of various herbaceous species, including *Carex nebrascensis*, *Juncus balticles*, and *Poa pratensis*. The remaining vegetation affected is classified as shrub dominated with an herbaceous understory. Dominant species include *Salix exiqua* (willow), *Chrysothamus nausemsus* (rabbitbrush), and *Distichlis spicata* (saltgrass).

Power Plant Air Emissions. Sulfur dioxide and nitrogen oxides are the primary gaseous emissions expected from operation of the proposed power plant. Anticipated maximum short-term (i.e., 24-hour) SO_2 and NO_x concentrations in the project region are reported in Table 5-1. This table is based on emissions estimates for total regional emissions including those from the proposed project.

Most research investigating the effects of air pollutants on plants has investigated the short-term effects of large doses on crop plants and other economically important plants. Hill et al. (1974) studied the response of desert plants to 2-hour SO_2 (Table 5-2) and NO_x doses. They concluded that many of the species showed high resistance to injury from SO_2 and NO_x, and that most species did not show clear leaf damage below the 2-4 ppm range. As shown in Table 5-2, none of the short-term maximum concentrations of emissions from operation of the power plant would exceed the range of 2-4 ppm. Thus short-term changes in regional vegetation composition and productivity are not expected.

The potential long-term effects of SO_2 and NO_x on vegetation depend on a variety of factors including the species, stage of development, soil moisture, light, air mass movements, precipitation, and presence of other gaseous emissions and particulate matter. Recent research on the effects of SO_2 and NO_x indicates that increasing dosages can result in metabolic or growth effects, foliar lesions, and plant death (citations). Nonvisible metobolic effects from NO_x can occur from exposure for 1000 hours at 0.1 ppm. This concentration is well above concentrations expected for the proposed project for comparable durations. It should be noted that many studies regarding the effects of common gaseous effluents on various biota have been performed under artificial greenhouse conditions rather than with plants growing in the field. These studies can indicate greater damage than would occur under natural conditions because of greater humidity and uneven fumigation.

Table 5-1. MAXIMUM 24-HOUR CONCENTRATION OF NO_x AND SO_2

	Projected TSPP ($\mu g/m^3$)	Background[a]	Total
Sulfur Dioxide	176.1	13.0	189.1
Nitrogen Oxides	396.2	9.0[b]	405.2

[a] Maximum concentration record at TSPP site June 15, 1981 - June 14, 1982.

[b] One-hour average (conservative estimate of 24-hour average).

Table 5-2. PERCENTAGE OF THE TOTAL LEAF AREA INJURED BY SO_2 DURING 2-HOUR FIELD FUMIGATION STUDIES IN NORTHWESTERN NEW MEXICO

Species	Average % Leaf Area Injured/2-hr Concentration of SO_2				Number of Replications			
	5,200 ppm	10,400 ppm	15,600 ppm	26,000 ppm	5,200 ppm	10,400 ppm	15,600 ppm	26,000 ppm
Big sagebrush (*Artemesia tridentata*)	0	4	9	2	2	5	7	3
Shadscale (*Atriplex confertifolia*)		0	0			1	1	
Cheatgrass (*Bromus tectorum*)	0	0	0	10	1	3	3	1
Snakeweed (*Gutierrezia sarothrae*)	0	0	21	78	4	2	13	3

Long-term field studies involving exposure to gaseous emissions in an environment similar to the proposed project size are limited. However, 8 years of observations for air pollutant damage in the Four Corners area by Hill et al. (1973, 1978) failed to detect any visible damage. Hill et al. systematically observed native vegetation and crop and garden plants, concentrating on species most sensitive to SO_2 and NO_x. Because pollution levels in the San Juan-Four Corner area were higher than those projected for the proposed project observation area, no pollution-caused observable changes in composition or production of native communities around the proposed TSPP site are expected within a comparable time period.

Other Trace Elements. Trace quantities of other compounds such as fluorides, mercury, and selenium may be released from operation of the proposed power station. None of the emissions for these compounds is expected to result in impacts to native vegetation or crops.

Synergistic Effects. Air pollutants may interact with one another to produce synergistic effects at concentrations lower than one pollutant action alone. To determine the effects of coal-fired emissions on native vegetation in the southwest, fumigation studies of native cold desert plant species were conducted by the University of Utah's Engineering Experiment Station in northwestern New Mexico. Portable chambers were placed over plants in the field and fumigated with SO_2 and with SO_2 and NO_x in combination. Each fumigation was of a 2-hour duration with the concentrations ranging from 0.5 to 11 ppm for SO_2 and from 0.1 to 5 ppm for NO_x. No synergistic effects were determined (Hill et al. 1974). Based on the short-term maximum concentrations expected for the proposed project (Table 5-1), no synergistic effects are anticipated for SO_2 when combining with NO_x.

Other investigations with garden crops showed that minor concentrations of 0.10 ppm ozone and 0.10 ppm sulfur dioxide caused damage (Tingey et al. 1973). Ozone levels at the proposed project site are expected to be low, based on measurements in remote parts of the world (0.01 to 0.05 ppm) (EPA

1986). Therefore, ozone levels are expected to be too low to produce synergistic effects when interacting with sulfur dioxide at present levels or at the expected levels when the proposed project is operating.

Groundwater Withdrawal Impacts to Riparian Vegetation. Potential impacts during operation to be provided after June 1989 survey.

5.2.2 Wildlife and Aquatic Species

5.2.2.1 Indicators of Impact Significance. Impacts to crucial wildlife and aquatic habitat and species were analyzed for several important categories of wildlife: recreationally or commercially important species (generally game species); species characterized by uncertain or declining population status; rare species; and species expected to be sensitive to project activities and which, as a result, may not be capable of sustaining current populations. Crucial habitat is defined as an area that is important for the maintenance and perpetuation of wildlife populations. Generally, these areas are characterized by population concentrations during critical periods (e.g., winter range, breeding or brooding grounds). Within these areas, populations are very susceptible to human disturbance and effects on individuals which may result in the loss of several generations. Species not included in categories designated as "important" include songbirds, small mammals, reptiles and amphibians, and insects. These species are not generally considered recreationally or commercially important, since they are usually capable of rapid recovery and repopulation of disturbed areas due to their large populations, rapid turnover rates, and mobility.

In order to evaluate the significance of impacts, both the quantity and quality of potentially affected habitat were considered. In general, important, crucial wildlife habitat areas were considered most significant. For example, 1 acre of year-long mule deer habitat was not considered as significant as 1 acre of riparian/wetland habitat. Further analysis was conducted to determine whether the nature of disturbance would create short-term or long-term impacts assuming:

- Short-term - The impact is not expected to last more than 5 years.
- Long-term - The impact is expected to last more than 5 years.

5.2.2.2 Impacts. Projected impacts to wildlife and aquatic resources resulting from the proposed TSPP project components are discussed in two general categories:

- Direct effects, which are caused by the action and occur at the same time and place.

- Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Some effects are clearly assignable to one of these categories, i.e., elimination of a rodent by a trenching machine is a direct effect, while the potential decline of a fishery in a distant mountain lake after exposure to 5 years of acid rain is an indirect effect. Other consequences may not be as easily categorized. Increased poaching would occur during not only construction periods, but would also occur in the future and in areas away from the proposed project as a result of the increased human population (indirect effect). Assessment of such impacts was accomplished by using demographic change information developed in the Socioeconomics Technical Report.

Direct Effects. Direct effects on animals would include loss of wildlife populations as the result of construction or operation of the proposed project components, or by destruction of habitat crucial to the animals' survival.

Unique and/or Highly Valued Wildlife. In general, direct effects to unique and/or highly valued wildlife would not result in significant displacement of big game or raptor species, since they exist in relatively low numbers and occupy large ranges in and adjacent to the plant site and proposed utility corridors. Because of the mobility of this group of animals, they would be likely to move to undisturbed adjacent areas avoiding construction activities.

Some year-long antelope range (Figure 4-1) and mule deer migration routes (Figure 4-3) could be disrupted in areas near the proposed access, utility corridors, and railroad routes. Impacts would result primarily from fencing of the access and railroad routes. Fencing in areas of year-round range and migration routes would result in interruption of both daily and seasonal movement patterns. One mule deer migration corridor will be impacted (Figure 4-3) by the fencing of the proposed access road. Migrating mule deer leaving winter ranges are in an weakened state and are, therefore, more susceptible to entanglement. Also, interruption of migration corridors could force these animals to utilize less than optimal habitat. Fencing of corridors could also impact antelope inhabiting Toano Draw. These impacts are considered significant and would require careful planning and consultation with NDOW and the BLM (Section 5.2.3.2). Fencing will meet BLM specifications to minimize the number of deaths or injuries to wildlife.

Upland Game Birds. Three sage grouse strutting grounds are located in the vicinity of proposed project components. Two are located on the western border of Toano Draw (northwest of the proposed plant site), and the third is located along the proposed water pipeline route from the Gamble wellfield. Although sage grouse may continue to utilize strutting grounds after road and/or water pipeline construction, the increased activity along a roadway could cause populations to disperse to other areas.

Small- and Medium-Sized Mammals. Any construction activity that would result in land surface disturbance and/or vegetation removal would probably destroy most of the small burrowing mammals within the disturbed area. Individuals that were not destroyed but were displaced could be lost to predation, stress, or failure to establish new territories. The high reproductive potential of small mammals and their ability to reinvade disturbed habitat indicate that repopulation of the reclaimed areas would be rapid, and impacts are not expected to be long-term.

Nongame Birds. The loss of habitat along linear proposed utility corridors or permanent facilities such as the plant site would have only short-term impact on most nongame birds foraging in proposed utility corridor ROWs or on the plant site. The area involved would probably constitute only a small proportion of the total area in which they normally forage, nest, or breed. This impact is considered to be localized, short-term, and not significant in terms of regional populations.

Reptiles and Amphibians. Construction activities at the proposed project components could result in direct mortality of some individuals particularly of species that are not very mobile or may have retreated to dens or nests. The loss of these individuals would have an immediate effect on local populations but would not have long-term significant impacts on regional populations.

Bird Collisions with Power Plant Structures. It is unlikely that there would be significant mortality of birds caused by collision with the 8 power plant stacks. Each stack would be 450 feet tall with flashing strobe lights on the tops of the structures. This design is unlikely to result in mortality of nocturnal migrating passerines, waterfowl, songbirds, waders, rails, and other species groups because more than 75 percent of these individuals typically migrate at altitudes greater than 1000 feet (Bellrose 1971). Most passerines, rails, waders (e.g., herons) and similar species groups migrate at night at altitudes between 1000 and 3000 feet. Most waterfowl (primarily ducks and geese) and snowbirds migrate at altitudes considerably greater than 1000 feet (up to 5000 to 20,000 feet).

Collisions and mortality of nocturnal migrants at tall, lighted structures typically occurs during periods of inclement weather (e.g., low clouds, fog, rain, mist) in the areas lighted structures (e.g., radio and television towers, stacks, tall buildings) which are more than 500 to 1000 feet tall. Such mortality caused by spatial disorientation. The magnitude of mortality at such structures which are less than 500 feet tall is considerably lower than at taller structures. Mortality is also typically higher at structures which have very substantial lighting (e.g., floodlights) as compared to structures with limited numbers of strobe lights.

During periods of inclement weather at night during spring migration (generally March to May) and fall migration (generally August to November) in the project area, it is possible that some deaths of nocturnal migrates will occur. The estimated magnitude of such kills is low and would probably be less than 50 individuals during any period of unfavorable conditions. This level of mortality could occur on a few nights in each migration period.

Collision mortality of birds involved in local, non-migratory and migratory movements during deligent periods is expected to be very low, typical of similar structure in comparable locations.

Indirect Impacts. Indirect impacts include the potential for population declines of displaced individuals and existing populations in habitats which are exposed to increased hunting and fishing pressures, poaching, and effects resulting from increased human activity during both construction and operation phases, such as noise, dust, harassment, road mortalities, or simple human presence in areas formerly isolated. As described above, the boundaries for impacts such as increased hunting and fishing pressures, poaching/random shooting, and road mortalities include the Snake Mountains east to the Utah state line and from Wells, Nevada north to the Idaho state line. Effects of each of these impact types is discussed below.

Increased Hunting/Trapping and Fishing Pressures. Increases in hunting/trapping and fishing pressures due to projected project-related population increases would likely result within the geographic area of influence. Management techniques in place that could minimize these increased pressures include tag regulations for hunting and restrictive regulations and higher stocking rates for fishing.

The greatest impacts would be the affects to the hunting experience of local residents because of increased competition for available tags. With the number of available tags at capacity, there could also be a slight increase in reduction of resident herds. However, with appropriate management practices this is not anticipated to significantly impact existing herds. The increases in trapping pressures are not anticipated to be significant because it is not a widely practiced activity.

Also, increased hunting for waterfowl in the geographic area of influence may reduce the numbers of birds and, therefore, decrease the value of the hunting experience. In terms of fishing, restrictive regulations that would be imposed by management agencies include use of artificial lures only, as well as size and catch limits. Lower stocking rates would be implemented in areas of high fishing demand and in order to discourage increased fishing demand.

Road Mortalities. Animal-vehicle collisions within the GAI could also increase with the expanding population from immigration. Higher traffic volume on highways, project-related access roads, and railways could result in increased road and railroad mortalities for big game species. Occurrences of road mortalities would likely be higher in areas where there are big game migration routes (Figures 4-1, 4-2, and 4-3).

Poaching. An increase in the number of poaching and random shooting violations of big game, raptors, doves, grouse, waterfowl, and other wildlife within the geographic area of influence would be expected to occur due to the increase in population during the construction and operation phases. Because of the wide territory encompassed by potential poaching and its consequent low discovery rate, in the majority of cases it is not possible to make growth-related impact projections with statistically meaningful confidence levels. A number of different factors such as age and socioeconomic groups, exposure to open country, law, and availability of wildlife enforcement can affect the occurrences of poaching violations. For purposes of this project, we have assumed an increase in the numbers of violations; however, no increase in the rate of poaching is anticipated based on the following assumptions which tend to balance and would, therefore, not change the poaching rate.

- The need for food would be reduced by provisions of the construction-worker camp.

- The workers residing in the construction-worker camp would be less likely to poach to the extent of those people living within the towns because they would have no facilities to dress and store game.

- Transient populations are generally younger, are less stable, possess less sense of community commitment, and have a lack of education towards maintaining local wildlife populations.

Estimates for potential increases in annual poaching incidence of mule deer due to the power plant construction and operation workforce vary from approximately 10 (low population years) to 35 (peak population years). This estimate is based on a current poaching rate in Region 2 of 0.029 deer poached per person (i.e., the number of observed poaches in Region 2 and a discovery rate estimated at 1.2 percent). The poaching rate of 0.029 was then applied to the anticipated range of additional workforce (from 270 to 1160). These assumptions are based on discussions with NDOW personnel and recent studies conducted in the state of Colorado and in Alberta, Canada. In conjunction with these investigations, NDOW personnel (Williams 1989) have arrived at a 1.2 percent discovery rate for poaching violations for mule deer and antelope. In other words, the number of poaching violations reported is predicted to be approximately only 1.2 percent of the number of poaches that actually occur. Elk are estimated to experience fewer poaching violations because of their high public profile.

Indiscriminate or random shooting of raptors is considered to be one of the major mortality factors for raptors and may increase within the GAI as a results of the proposed project. Indiscriminate shooting could have an impact on raptor populations, depending upon the extent of increased shooting and the species involved. These impacts are considered to be long-term because the potential effects of shooting on raptor population levels would likely occur throughout the construction phase of the project.

Human Disturbance. Noise, vehicular movement, and harassment could result from increased human presence/activities in stress-related impacts to antelope, mule deer, and elk. Daily or seasonal movements could be affected as well as feeding habits. Short-term impacts could result locally, although these are not expected to be significant.

Noise. Noise generated from the construction of the power plant would increase short-term noise levels above existing conditions on an intermittent basis. At a distance of approximately ½ mile construction noise would attenuate to a range of 54-64 dBA, or about the level generated by normal construction. The amount of disturbance to wildlife is dependent on the sensitivity of a particular species (Moore and Mills 1977). Big game mammals, raptors, and breeding birds would most likely avoid areas within ½ mile of construction activities, thereby reducing the amount of habitat available for wildlife. However, since there is no critical habitat, such as a big game winter range or raptor breeding site, within ½ mile of the construction areas, no significant impacts are expected.

Noise impacts to wildlife resulting from the operation of the proposed plant would be similar to those projected for constructing the power plant. The predicted maximum hour sound levels around the TSPP boundary indicate a decibel range of 58 to 71. The levels further from the plant boundary are expected to be lower. Comparatively, the operational noise levels, however, would be more constant than the noise created by construction activities. The relatively constant noise source would allow animals to acclimate to increased decibel levels. Mammals and birds that may be displaced from the TSPP site to other areas will encounter increased competition for resources. Most mobile animals will disperse into other areas until the noise level falls below an acceptable background level (Moore and Mills 1977). Since the vegetation will be cleared for the construction of the power plant, these animals would be displaced from the area even if there was no increase in noise levels. Thus, impacts to wildlife will be similar to those resulting from the clearing of construction areas and would be limited primarily to the area within the TSPP boundaries. As discussed above for construction noise, no significant or critical wildlife habitat would be affected.

Acid Rain. The term "acid rain" is generally understood to describe precipitation that has a pH lower than 5.6 (the approximate pH of distilled water equilibrated with atmospheric concentrations of CO_2) (Haines 1981). The mathematical models used to predict the effect of acid rain in the environment include calculations for dry depositon rates of sulfur and nitrogen. Thus, discussions of acid rain include impacts of dry depostion. Within the Thousand Springs Basin any acid rain that is formed due to operation of the TSPP or other sources would probably be neutralized because of the high alkaline content of soils in this region. Further, since rainfall is low in this area, the occurrence of such rain would be very infrequent.

Acid rain formation appears to be a long-range transport phenomenon. The potential exists to contribute to acid rain impacts in high mountain lakes in areas outside the Thousand Springs Basin.

5.2.3 Mitigation

There are three categories of biological resource mitigations, including planning, design and construction commitments, and other. The implementation of these mitigations is anticipated to minimize or alleviate levels of expected impacts on biological resources and endangered species within the project area. Suggested mitigation measures include:

5.2.3.1 Planning.

- Conduct work in streams in a manner that minimizes siltation and erosion. Erosion and sedimentation may be controlled by containing drainage onsite during construction. Other erosion control measures shall consist of preparing slopes, replacing topsoil, applying fertilizer, and seeding areas left barren after construction completion.

- To minimize disturbance to plants and wildlife species, soil (erosion) and tree (raptor roosts/nests) removals will be the least amount necessary to construct the power plant. The exact amount of these disturbances are not presently known.

5.2.3.2 Design and Construction Commitments.

- BLM provides criteria at start of design to set forth requirements to minimize disturbance within and adjacent to the project area.
- Utilize erosion controls during construction activities.
- Restrict off-road vehicle use by the construction workforce in the project vicinity.
- Prohibit unauthorized firearms in the TSPP area. Although is restriction is not enforceable, it will be TSGC's policy to restrict firearms within the construction-worker camp and power plant facilities. Workers failing to comply with is restriction could risk termination.
- Revegetate with BLM-approved species as appropriate for soil stabilization and to speed recovery of lost vegetation.
- Dust control measures shall consist of applying water to minimize dust emissions created during construction. Water will be applied at locations by means of pressure-type sprayers designed to insure a uniform application of water. Dust palliatives will not be used unless the engineer decides that they would be more effective as a control measure.
- Construction lay-down areas (assembly areas for construction) will not be located near stream crossings in riparian or other sensitive habitats.

- Restrict vehicle maintenance activities to areas away from stream banks.

- After cable/utility lines are installed, the top soil will be restored following BLM procedures.

- The fence specifications for the access routes and railroad right-of-way will be in accordance with BLM standards. A three-wire fence with 22-foot post spacings will be installed along the corridors. The three wires from the bottom up will be placed at 16, 10, and 12 inches, with a smooth bottom wire.

- Realignment of the proposed access road, wellfield power line, and water supply pipeline in the area of known sage grouse strutting grounds will be considered to avoid impacting these breeding locations.

- Prohibit unauthorized firearms in the TSPP area. Although is restriction is not enforceable, it will be TSGC's policy to restrict firearms within the construction-worker camp and power plant facilities. Workers failing to comply with is restriction could risk termination by TSGC.

5.2.3.3 Other Measures.

- Have a site representative designated to act as liaison with the BLM for compliance with regulations and stipulations.

- Have a BLM biologist/botanist act as an advisor to provide direct on-site input to ensure the Contractor's compliance with mitigation stipulation in biologically sensitive areas.

Springs on public lands or lands not owned by Lands of Sierra, Inc. should be monitored to detect any decrease in flowrate which could affect water availability for vegetation and wildlife. If water availability decreases, the following mitigation measures should be considered:

- Installation of a shallow well in the vicinity of the affected spring in order to replenish springwater.
- If a well cannot be completed successfully, water should be transported by truck or pipeline to the spring vicinity and placed in a trough or wildlife guzzler.

The BLM and the applicant should consult to determine the specifications for the trough or guzzler to be used, the specific location, and the period/ frequency that water would be supplied. If vegetation associated with the springs becomes degraded due to a lack of water, the BLM and the applicant should consult to determine if water should be added directly to the spring area to provide water to affected vegetation.

SECTION 6

6.0
REFERENCES

Audubon Society. 1977. Field Guide to North American Birds. New York: Borzoi Books.

___. 1980. Field Guide to North American Mammals. New York: Borzoi Books.

___. 1983. Master Guide to Birding. Vols. 1, 2, & 3. New York: Borzoi Books.

___. n.d. Field Guide to North American Fishes, Whales and Dolphins. New York: Borzoi Books.

Bellrose, F.C. 1971. The Distribution of Nocturnal Migrants in the Air Space. Auk 88: pp. 397-424.

Bureau of Land Management (BLM). 1971. Birds - Elko BLM District. BLM, Elko, Nevada. February.

Bureau of Land Management (BLM). 1986. An inventory of waters and riparian/ aquatic habitats on offered private lands in the Snake Mountains owned by Lands of Sierra. Wells Resource Area, Elko District, Nevada.

Bureau of Land Management (BLM). 1988. North Eccles pronghorn antelope habitat management plan. Wells Resource Area, Elko District, Nevada.

Code of Federal Regulations. 1986. Rules and Regulations, Volume 51, No. 219, November 13, 1986.

Environmental Protection Agency (EPA). 1986. Air quality criteria for ozone and other photochemical oxidants. Environmental Criteria and Assessment Office, Research Triangle Park, NC.

Findley, J.S., A.H. Harris, D.E. Wilson, and C. Jones. 1975. Mammals of New Mexico. Albuquerque: University of New Mexico Press.

Haines, J.A. 1981. Acidic Precipitation and its Consequences for Aquatic Ecosystems: a Review. Trans. Am. Fish Soc. 110: pp. 669-707.

Hall, E.R. 1946. Mammals of Nevada. Berkeley: University of California Press.

Herron, G.B., C.A. Mortimore, and M.S. Rawlings. 1985. Nevada Raptors. Nevada Department of Wildlife Biological Bulletin No. 8. Reno, Nevada.

Hill A., T. Barrett, H. Price, and J. Allan. 1978. New Mexico vegetation studies in the vicinity of the San Juan and Four Corners power plants. 1978 Progress Report to Public Service Company of New Mexico and Arizona Public Service Company.

Hill, A., S. Hill, C. Lamb, and T. Barrett. 1974. Sensitivity of native desert vegetation to SO_2 and to SO_2 and NO_2 combined. Journal of the Air Pollution Control Association 24(2): pp. 153-157.

Hill, A., H. Price, K. Harper, T. Barrett, T. Nash, S. Waite, and R. Harner. 1973. Vegetation air pollution investigations in the vicinity of the Four Corners and San Juan power plants, New Mexico. 1973 Progress Report to Public Service Company of New Mexico and Arizona Public Service Company.

Lister, R. 1989. Wildlife Biologist, Bureau of Land Management. Personal communication with Woodward-Clyde Consultants. September.

Moore, R., and T. Mills. 1977. An Environmental Guide to Western Surface Mining. Part Two: Impacts, Mitigation, and Monitoring. Office of Biological Services, Fish and Wildlife Service, FWS/OBS-78/04.

Nevada Department of Wildlife (NDOW). 1989. Wildlife Critical Habitat Maps. Region II Office, Elko, Nevada.

Nevada Department of Wildlife (NDOW). n.d. Checklist - Birds of Northeastern Nevada.

Peterson, R.T. 1961. Field Guide to Western Birds. Second Edition. Boston.

Portwood, B. 1989. Wildlife Biologist, Bureau of Land Management. Personal communication with Woodward-Clyde Consultants. September.

Rollins, R.C. 1982. Studies on Arabis (Cruciferae) in western North America II. Contributions of Gray Herbarium, H.

Tingey, D.T., R.A. Reinert, J.A. Dunning, and W.W. Heck. 1973. Foliar Injury Responses of Eleven Plant Species to Ozone/Sulfur Dioxide Mixtures. Atmospheric Environment 6: pp. 201-208.

U.S. Department of Agriculture (USDA). 1985. Final Environmental Impact Statement for the Humboldt National Forest Land and Resource Management Plan, Forest Service, Humboldt National Forest, Elko, NV.

Williams, J. 1985. Pronghorn antelope release site description. Nevada Department of Wildlife, Wells, NV.

Williams, J. 1989. Wildlife Biologist, Nevada Dept. of Wildlife. Personal communication with Woodward-Clyde Consultants. March.

Woodward-Clyde Consultants (WCC). 1981-88, 1986. Field surveys conducted by Woodward-Clyde Consultants.

APPENDIX A

APPENDIX A
VEGETATION DATA

BLM Library
Denver Federal Center
Bldg. 50, OC-521
P.O. Box 25047
Denver, CO 80225

WOODY PLANT SPECIES DENSITY
Stems/acre

Species	T - 1		T - 2		T - 3		Average	
	adult	seed	adult	seed	adult	seed	adult	seed
Artemisia tridentata Vegetation Type - Big Sagebrush								
ARTR	4,154.9	3,075.7	4,748.5	18,939.9	5,719.8	20,181.0	4,874.4	7,758.5
CHVI	2,131.4	134.9	1,942.6	4,800.2	1,510.9	242.8	1,861.6	197.8
ATCO	269.8		27.0		242.8		179.9	0.0
OPPO			27.0				9.0	
Total								
Artemisia nova Vegetation Type - Black Sagebrush								
ARNO	9,766.8	1,025.5	8,471.7	1,429.9	6,933.9	1,564.8	8,390.8	1,339.9
CHVI	377.7	27.0	134.9		1,483.9		665.5	9.0
ATCO	188.9		323.7		242.8		251.8	0.0
ATSP					53.9		17.9	0.0
ARTR					350.7		116.9	0.0
Total								
Atriplex falcata Vegetation Type - Saltbrush								
ATFA	53,636.2	1,753.7	64,671.1	1,591.8	58,708.5	728.5	59,005.3	1,358.0
ARTR	728.5	134.9	404.7	27.0	53.9	133.3	395.7	53.9
Total								
Atriplex confertifolia Vegetation Type - Shadscale								
ATCO	12,572.7	53.9	11,169.7		9,712.8		11,151.7	17.9
ARTR	323.8	134.9					107.9	44.9
CELA	27.0						9.0	
Total								

HERBACEOUS VEGETATION COVER DATA

	T - 1[1]		T - 2		T - 3		Average	
Species	%[2]	Rel.[3]	%	Rel.	%	Rel.	%	Rel.
Artemisia tridentata Vegetation Type - Big Sagebrush								
SIHY[4]	1.0	7.1	7.4	47.4	2.2	12.4	3.5	22.4
ORHY[5]	T[13]		T				T	0.9
POSE[6]	0.7	4.6	0.2	1.3			0.3	2.0
Arabis[7]	T					T	T	
Moss	12.6	87.9	7.8	50.0	15.6	87.4	12.0	75.1
BRTE[8]			0.2	1.3			0.1	0.4
Vegetation	14.3		15.6		17.8		15.9	
Rock	21.0		8.4		13.6		14.3	
Bareground	52.7		60.4		58.0		57.1	
Litter	12.0		15.6		10.6		12.7	
Artemisia nova Vegetation Type - Black Sagebrush								
PHHO[9]					0.2	2.6	0.1	0.9
EROV[10]	T	0.2			T	0.3	T	0.2
BRTE					T	0.2	T	0.1
Moss	12.6	99.8	9.6	92.0	7.0	90.4	9.7	90.4
SIHY			0.4	4.2	T	0.5	0.1	1.6
ORHY			0.4	3.8	0.4	5.4	0.3	3.1
TRDU[11]					T	0.3	T	0.1
Arabis					T	0.1	T	0.2
Vegetation	12.6		10.4		7.6		10.2	
Rock	31.0		30.4		29.0		30.1	
Bareground	51.8		48.4		57.5		52.6	
Litter	4.6		10.8		5.8		7.1	
Atriplex falcata Vegetation Type - Saltbrush								
SIHY	7.4	94.6	0.1	1.5	0.6	68.9	2.7	55.0
ORHY	0.4	5.4	3.8	98.0	0.2	24.4	1.5	42.6
DESP[12]			T	0.5	0.1	6.7	T	2.4
Vegetation	7.8		3.9		0.9		4.2	
Rock	0.0		0.0		0.0		0.0	
Bareground	81.6		90.5		96.1		89.4	
Litter	10.6		5.6		3.0		6.4	

SHRUB COVER DATA

Species	T -1[1]		T-2		T-3		Average	
	%[2]	Rel.[3]	%	Rel.	%	Rel.	%	Rel.
Artemisia tridentata Vegetation Type - Big Sagebrush								
ARTR[4]	27.1	84.2	28.7	86.9	35.4	89.0	30.4	86.7
CHVI[5]	4.0	12.3	2.8	8.4	3.8	9.7	3.5	10.1
ATCO[6]	1.1	3.5	1.6	4.7	0.5	1.3	0.5	3.1
Subtotal	32.2		33.1		39.7		35.4	
Artemisia nova Vegetation Type - Black Sagebrush								
ARNO[7]	36.5	95.0	38.9	98.2	36.2	89.7	37.2	94.3
ATCO	0.6	1.6	0.7	1.7	0.3	0.6	0.5	1.3
CHVI	1.3	3.4	-		3.9	9.7	1.7	4.3
Subtotal	38.4		39.6		40.4		39.4	
Atriplex falcata Vegetation Type - Saltbrush								
ATFA[8]	22.3	99.0	23.4	100.0	21.0	100.0	22.2	100.0
ARTR	0.2	1.0	-		-	0.1	0.3	
Subtotal	22.5		23.4		21.0		22.3	
Atriplex confertifolia Vegetation Type - Shadscale								
ATCO	15.7	100.0	17.5	100.0	18.0	100.0	17.0	100.0
Subtotal	15.7		17.5		18.0		17.0	

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[1] T - 1 = Transect number sampled for the site
[2] % = Absolute cover
[3] Rel. = Relative cover
[4] ARTR = *Artemisia tridentata*
[5] CHVI = *Chrysothamnus nauseosus*
[6] ATCO = *Atriplex confertifolia*
[7] ARNO = *Artemisia nova*
[8] ATFA = *Atriplex*

HERBACEOUS VEGETATION COVER DATA
(Continued)

	T - 1		T - 2		T - 3		Average	
Species	%	Rel.	%	Rel.	%	Rel.	%	Rel.
Atriplex confertifolia Vegetation Type - Shadscale								
SIHY	11.7	74.5	11.0	87.3	9.8	71.0	10.8	77.6
ORHY	2.8	18.8	0.6	4.9	0.4	2.9	1.3	8.9
Moss	1.0	6.7	1.0	8.2	3.6	26.1	1.9	13.7
DESP	T	0.1	T	0.2			T	0.1
Vegetation	15.5		12.6		13.8		14.0	
Rock	0.0		0.4		0.0		0.1	
Bareground	74.5		78.0		75.6		76.0	
Litter	10.0		9.0		10.6		9.9	

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[1] T - 1 = Transect number sampled for the site
[2] % = Absolute cover sampled
[3] Rel. = Relative cover
[4] SIHY = *Sitanion hystrix*
[5] ORHY = *Oryzopsis hymenoides*
[6] POSE = *Poa secunda*
[7] Arabis = *Arabis* spp.
[8] BRTE = *Bromus tectorum*
[9] PHHO = *Phlox hoodii*
[10] EROV = *Eriogonum ovalifolium*
[11] TRDU = *Tragopogon dubius*
[12] DESP = *Descurania* spp.
[13] T = Trace; amount less than 0.01 cover. It should also be noted that all speci were recorded for each transect. Species that appear with no number did n occur within the sampled transect.

PHYSIOGNOMY FAMILY	SPECIES	COMMON NAME	VEGETATION TYPE						
			ATGA	ARNO	ATCO	ARTR	CELA	CHVI	WASH
TREES									
CUPRESSACEAE									
	Juniperus osteosperma	Utah juniper		x		x			
SHRUBS									
CHENOPODIACEAE									
	Atriplex confertifolia	shadscale	x	x	x	x	x	x	
	Atriplex falcora	sickle saltbush	x						
	Ceratoides lanata	winterfat	x	x	x	x	x	x	
	Grayia spinosa	hopsage		x		x		x	
COMPOSITAE									
	Artemisia nova	black sagebrush		x					
	Artemisia spinescens	budsage		x	x	x	x	x	
	Artemisia tridentata	big sagebrush	x	x	x	x	x	x	x
	Chrysothamnus nauseosus	rubber rabbitbrush			x				x
	Chrysothamnus viscidiflorus	viscid rabbitbrush		x	x	x	x	x	x
	Tetradymia canescens	gray horsebush		x				x	
SUCCULENTS									
CACTACEAE									
	Opuntia polycantha	prickly-pear		x		x		x	
	Pediocactus simpsonii	Simpson footcactus		x		x			
GRAMINOIDS									
GRAMINEAE									
	Agropyron cristatum	crested wheatgrass	x	x	x	x	x	x	x
	Bromus tectorum	cheatgrass	x	x	x	x	x	x	x
	Oryzopsis hymenoides	Indian ricegrass	x	x	x	x	x	x	x
	Poa secunda	sandberg bluegrass	x	x	x	x	x	x	x
	Sitanion hystrix	squirreltail	x	x	x	x	x	x	x
FORBS									
BORAGINACEAE									
	Cryptantha humilus	dwarf cryptantha		x		x			
CHENOPODIACEAE									
	Halogeton glomeratus	halogeton			x	x			
COMPOSITAE									
	Crepis acuminata	mountain hawksbeard				x			
	Erigeron pumilus	fleabane daisy		x					
	Haplopappus acaulis	stemless goldenweed		x					
	Machaeranthera canescens	hoary aster	x		x	x		x	
	Machaeranthera grindelioides	gumweed aster		x					
	Senecio multilobatus	groundsel				x			
	Stephanomeria spinosa	thorn wirelettuce			x				
	Townsendia florifer	Townsendia		x					

PHYSIOGNOMY FAMILY	SPECIES	COMMON NAME	VEGETATION TYPE ATGA	 ARNO	 ATCO	 ARTR	 CELA	 CHVI	 WASH
FORBS (CONTD.)									
CRUCIFERAE									
	Arabis sparsiflora	sickle rockcress				x			
	Arabis holboellii	holboell rockcress		x		x		x	
	Descuriania sp.	tansymustard	x		x	x	x	x	x
	Erysimum asperum	wallflower							
	Lepidium perfoliatum	peppergrass				x	x		
LEGUMINOSAE									
	Astragalus lentiginosus	freckled milkvetch				x			x
	Astragalus sp.	locoweed	x					x	
	Lupinus sp.	lupine							x
MALVACEAE									
	Sphaeralcea coccinea	globemallow		x		x		x	
ONAGRACEAE									
	Oenothera caespitosa	morning-lily		x					
POLEMONIACEAE									
	Gilia congesta	gilia		x				x	
	Phlox hoodii	carpet phlox	x			x		x	
POLYGONACEAE									
	Eriogonum caespitosum	mat buckwheat		x					
	Eriogonum ovalfolium	cushion buckwheat		x		x		x	
SCROPHULARIACEAE									
	Penstemon sp.	beardstongue		x					
UMBELLIFERAE									
	Cymopterus sp.	spring parsley		x					

ATGA: saltbush; ARNO: black sagebrush; ATCO: shadscale; ARTR: big sagebrush; CHVI: viscid rabbitbrush; WA: wash;

PHYSIOGNOMY FAMILY SPECIES	COMMON NAME	HABITAT	
		UPLAND	RIPARIAN
TREES			
SALICACEAE			
Populus tremuloides	aspen	x	
SHRUBS			
BERBERIDACEAE			
Mahonia repens	Oregon grape	x	
CAPRIFOLIACEAE			
Symphoricarpos oreophilus	mountain snowberry	x	
CHENOPDIACEAE			
Grayia spinosa	hopsage	x	
COMPOSITAE			
Artemisia arbuscula	low sagebrush	x	
Artemisia tridentata	big sagebrush	x	x
Chrysothamnus viscidiflorus	viscid rabbitbrush	x	
ROSACEAE			
Amelanchier utahensis	Utah serviceberry	x	
Prunus virginiana	chokecherry	x	x
Purshia tridentata	bitterbrush	x	
Rosa woodsii	woods rose	x	x
SALICACEAE			
Salix boothii	booth willow		x
Salix geyeriana	geyers willow		x
Salix lasiandra	pacific willow		x
SAXIFRAGACEAE			
Ribes aureum	golden currant	x	x
Ribes cereum	squaw currant	x	x
GRAMINOIDS			
CYPERACEAE			
Carex douglasii	Douglas sedge	x	
Carex microptera	smallwing sedge		x
Carex nebrascensis	Nebraska sedge		x
Carex sp.	sedge		x
Eleocharis sp.	spikerush		x
Scirpus microcarpus	panicled bulrush		x
EQUISETACEAE			
Equisetum laevigatum	smooth horsetail		x

PHYSIOGNOMY FAMILY	SPECIES	COMMON NAME	HABITAT	
			UPLAND	RIPARIAN
GRAMINEAE				
	Agropyron cristatum	crested wheatgrass	x	
	Agropyron spicatum	bluebunch wheatgrass	x	
	Agrostis stolonifera	carpet bentgrass		x
	Alopecurus aequalis	short-awn foxtail		x
	Bromus carinatus	mountain brome	x	
	Bromus tectorum	cheatgrass	x	
	Catabrosa aquatica	brookgrass		x
	Elymus cinerous	basin wildrye	x	x
	Festuca idahoensis	Idaho fescue	x	
	Melica bulbosa	oniongrass	x	
	Oryzopsis hymenoides	Indian ricegrass	x	
	Poa fendleriana	muttongrass	x	
	Poa pratensis	Kentucky bluegrass	x	x
	Poa secunda	Sandberg bluegrass	x	
	Sitanion hystrix	squirreltail	x	
	Stipa sp.	needlegrass	x	
JUNCACEAE				
	Juncus balticus	baltic rush		x
SUCCULENTS				
CACTACEAE				
	Opuntia sp.	prickly-pear	x	
FORBS				
BORAGINACEAE				
	Cryptantha humilus	dwarf cryptanth	x	
	Hackelia patens	pale stickseed	x	
	Lappula occidentalis	western stickseed	x	
	Lithospermum ruderale	stoneseed	x	
	Mertensia oblongifolia	western bluebell	x	
CARYOPHYLLACEAE				
	Arenaria fendleri	Fendler sandwort	x	
	Stellaria sp.	starwort		x
COMPOSITAE				
	Achillea millefolium	common yarrow	x	x
	Agoseris glauca	pale agoseris	x	
	Artemisia ludoviciana	Louisiana sagewort	x	x
	Aster scopulorum	Crag aster	x	
	Aster sp.	aster	x	x
	Balsamorhiza sagittata	arrowleaf balsamroot	x	
	Chaenactis douglasii	Douglas dustymaiden	x	
	Cirsium sp.	thistle	x	
	Crepis acuminata	tapertip hawksbeard	x	
	Erigeron sp.	daisy	x	
	Iva axillaris	povertyweed	x	
	Machaeranthera canescens	hoary aster	x	

PHYSIOGNOMY FAMILY	SPECIES	COMMON NAME	HABITAT UPLAND	 RIPARIAN
COMPOSITATE (CONTD.)				
	Senecio integerrimus	wet-the-bed	x	
	Senecio serra	butterweed		x
	Sonchus oleraceous	common thistle		x
	Taraxacum officinale	common dandelion	x	x
	Tragopogon dubius	goatsbeard	x	
	Wyethia amplexicaulis	mulesear	x	
CRUCIFERAE				
	Arabis holeboeli	Holboell rockcress	x	
	Arabis sparsiflora	sickle rockcress	x	
	Capsella bursa-pastoris	shepherds purse		x
	Caulanthus crassicaulis	spindlestem	x	
	Draba douglasii	Douglas draba	x	
	Lepidium perfoliatum	peppergrass	x	
	Sisymbrium altissimum	tumble mustard	x	
	Thlaspi arvense	field pennycress	x	
GERANIACEAE				
	Geranium sp.	geranium	x	x
HYDROPHYLLACEAE				
	Hydrophyllum capitatum	ballhead waterleaf	x	x
	Phacelia hastata	spearshaped phacelia	x	
IRIDACEAE				
	Iris missouriensis	rocky mountain iris		x
LEGUMINOSAE				
	Astragalus sp.	locoweed	x	x
	Lupinus sp.	lupine	x	
	Medicago lupulina	black medic		x
LILIACEAE				
	Allium acuminatum	tapertip onion	x	
	Allium sp.	onion	x	x
	Smilacina stellata	false solomon-seal		x
	Veratrum californicum	false hellebore		x
	Zigadenus paniculatus	foothill deathcamus	x	
MALVACEAE				
	Sidalcea oregana	Oregon checkermallow	x	
	Sphaeralcea sp.	globemallow	x	
ONAGRACEAE				
	Epilobium sp.	willowweed		x
PAEONIACEAE				
	Paeonia brownii	peony	x	
POLEMONIACEAE				
	Collomia linearis	slenderleaf collomia	x	
	Phlox hoodii	carpet phlox	x	
	Phlox longifolia	longleaf phlox	x	

PHYSIOGNOMY			HABITAT	
FAMILY	SPECIES	COMMON NAME	UPLAND	RIPARIAN
POLYGONACEAE				
	Eriogonum caespitosum	mat buckwheat	x	
	Eriogonum heracleoides	whorled buckwheat	x	
	Eriogonum ovalifolium	cushion buckwheat	x	
	Polygonum sp.	knotweed	x	
	Rumex crispus	curlydock	x	
PORTULACEAE				
	Lewisia rediviva	bitterroot	x	
RANUNCULACEAE				
	Delphinium nuttallianum	Nelson larkspur	x	
	Ranunculus aquatilis	water crowfoot		x
	Ranunculus cymbalaria	alkali buttercup		x
	Ranunculus testiculatus	bur buttercup	x	
ROSACEAE				
	Geum macrophyllum	largeleaf avensa		x
	Potentilla biennis	biennial cinquefoil		x
	Potentilla gracilis	northwest cinquefoil		x
RUBIACEAE				
	Galium aparine	catchweed bedstraw		x
	Galium bifolium	twinleaf bedstraw		x
SANTALACEAE				
	Comandra umbellata	bastard toadflax	x	
SAXIFRAGACEAE				
	Heuchera parviflora	littleleaf alumroot	x	
SCROPHULARIACEAE				
	Castilleja sp.	paintbrush	x	
	Collinsia parviflora	blue-eyed Mary	x	
	Mimulus guttatus	common monkeyflower		x
	Penstemon humilis	low penstemon	x	
	Penstemon sp.	beardstongue	x	
	Veronica sp.	speedwell		x
UMBELLIFERAE				
	Lomatium nudicaule	naked-stem lomatium	x	
	Lomatium sp.	parsley	x	
URTICACEAE				
	Utrica dioca	nettle		x
VALERIANACEAE				
	Valeriana edulis	valeriana	x	
VIOLACEAE				
	Viola sp.	violet	x	x